Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

Dean K. Matsuura
Manager
Regulatory Affairs

August 18, 2009

FILED
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PUBLIC UTILITIES COMMISSION

The Honorable Chairman and Members of
the Hawaii Public Utilities Commission
Kekuanaoa Building, First Floor
465 South King Street
Honolulu, Hawaii 96813

Dear Commissioners:

Subject: Docket No. 2008-0083 – Hawaiian Electric 2009 Test Year Rate Case
Hawaiian Electric's Responses to Commission Information Requests

Enclosed for filing are Hawaiian Electric Company, Inc.'s ("Hawaiian Electric" or "Company") responses to information requests ("IRs") PUC IRs 106, 107, and 109, issued by the Commission to Hawaiian Electric on August 3, 2009.[1]

Very truly yours,

for Dean K. Matsuura
Manager, Regulatory Affairs

Enclosures

cc: Division of Consumer Advocacy
Michael L. Brosch, Utilitech, Inc.
Joseph A. Herz, Sawvel & Associates, Inc.
Dr. Kay Davoodi, Department of Defense
James N. McCormick, Department of Defense
Theodore E. Vestal, Department of Defense
Ralph Smith, Larkin & Associates

[1] On August 17, 2009, the Company filed a request with the Commission to file responses to these IRs by August 20, 2009.

PUC-IR-106

Reference: Act 162 (2006)
HECO ST-10B at 8 – 9

HECO filed Supplemental Testimony of Dr. Jeff D. Makholm, on Behalf of Hawaiian Electric Company, Inc. on July 20,2009. Dr. Makholm stated the following:

> The ECAC, with its "heat rate" efficiency factor... , provides a partial pass-through of fuel costs. It shares the costs and/or benefits of decreased or increased plant operating efficiency by tying HECO's ability to recover its fuel costs (and financial performance) to its power plant performance[.]

Please provide:

a) details of historical incidents where HECO could not reach heat rate efficiency factors in the past three years or the past ten incidents, whichever shorter time frame is applicable;
b) the financial impact to HECO in each incident;
c) an explanation as to why HECO could not meet the required heat rate;
d) an explanation of actions the company took or may take in the future to remediate possible recurrences of the incidents;
e) notwithstanding remediation measures, details of any recurrences and reasons for the recurrences.

<u>HECO Response:</u>

a. As described in HECO's response to PUC-IR-109, the point at which the energy exits the transformers and enters the power grid is referred to as the "net-to-system" point. Net heat rate is calculated at this point. The amount of energy arriving at customers' meters, called the "customer level" or "sales level", is less than the amount of energy delivered at the net-to-system point because of losses described in HECO's response to PUC-IR-109. The heat rate at the "sales level" is the sales heat rate. Because HECO calculates the financial impact of heat rate only at the sales level, all references to heat rate in this response is to HECO's sales heat rate.

A "historical incident" in the context of part a of this information request is defined as a month in which the sales heat rate exceeded the reference sales heat rate value.

Details of the past ten monthly periods where a historical incident occurred are provided in Attachment 1 to this response. The most recent ten historical incidents span back to April 2007, but because the data is presented for the entire year of 2007, a total of 12 historical incidents are reflected in the data.

b. The monthly financial impacts are provided in Attachment 1. Financial results are not yet available for July 2009.

c. Explanations when the monthly sales heat rate exceeded the referenced sales heat rate are included in Attachment 1.

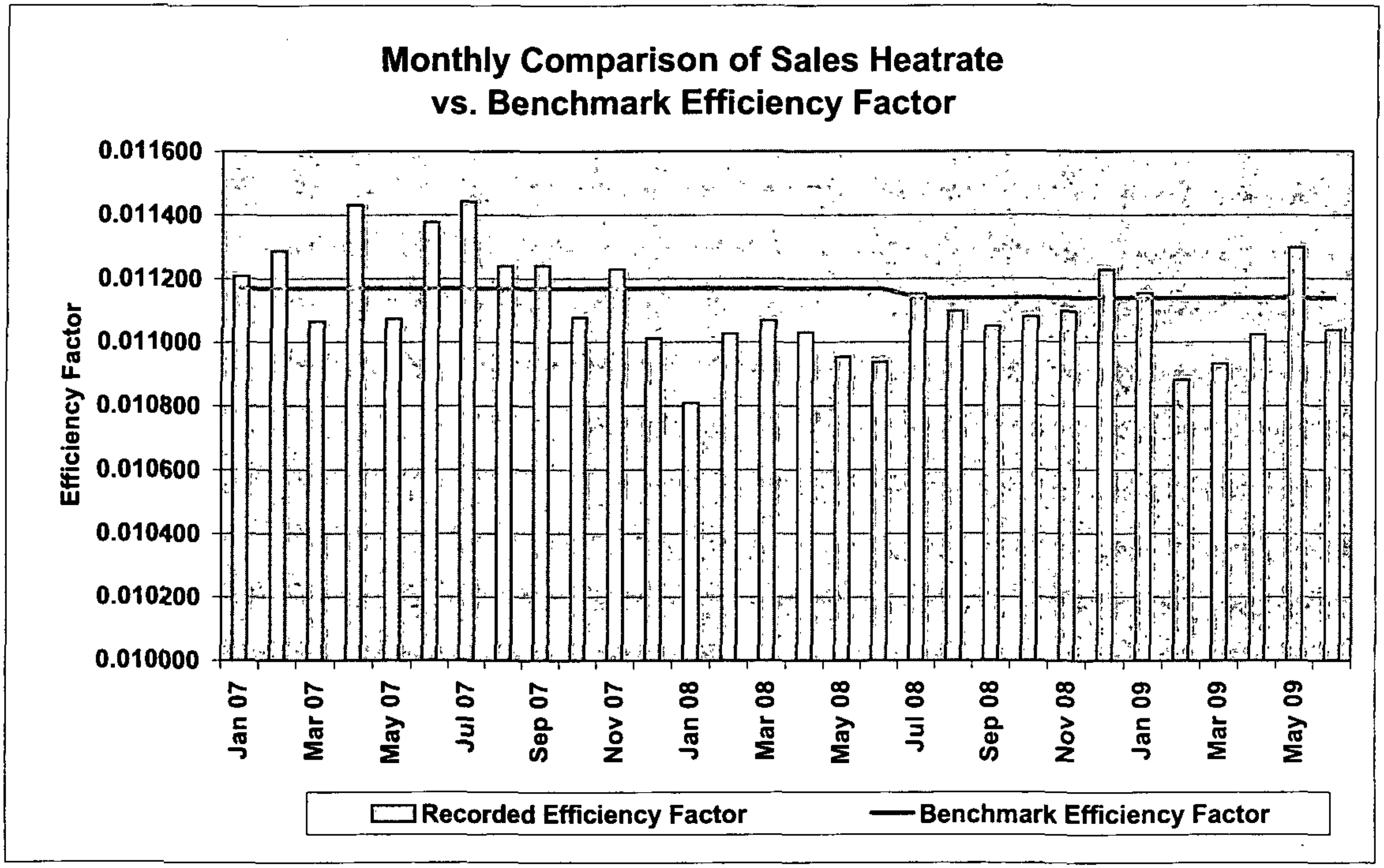
d. As described in HECO's response to PUC-IR-107, HECO actively monitors and manages generating unit heat rate performance. However, depending upon the work requirements, resource requirements, system demands, system spinning reserve and quick load pickup reliability constraints, actual net and sales heat rates may be negatively impacted by occurrences such as simultaneous maintenance outages of base load generating units. From time to time such occurrences are simply unavoidable. Described below are explanations of actions taken to remediate recurrences where possible:

- Multiple Feedwater Heater outages: Since the failure of the #84 feedwater heater on Waiau 8 in 2005, HECO has undertaken an extensive program to replace problematic feedwater heaters.
- Multiple Reheat Unit outages: Multiple reheat unit outages are driven by equipment problems and are unavoidable. As much as possible, reheat unit outages are delayed to the extent possible to minimize any overlap.

- High Sales: Higher than expected sales, which force the operation of less efficient units to meet demand, is unexpected and unavoidable. Less efficient units may be required to run to meet the demand at the expense of heat rate.
- Stacked Outages: Stacked unit outages are driven by unforeseen equipment problems and work requirements, and are unavoidable. As much as possible, reheat unit outages are delayed to the extent possible to minimize any stacking.
- System-wide Outage (12/26/08): The island-wide outage of 12/26/08 was caused by a lightning storm incident.
- W3 & W6 24/7 Operation of Cycling Units: 24/7 operation of cycling units are driven by system requirements or outages of other units and are unavoidable to meet system demands.
- Degraded Boiler Performance: Outages to correct the degraded performance are scheduled as soon as possible, within the constraints of the system and the availability of resources and materials.
- Severe Derate: Outages to correct the derated performance are scheduled as soon as possible, within the constraints of the system and the availability of resources and materials.

e. Please see the response to subpart d., above.

HAWAIIAN ELECTRIC COMPANY, INC.
2009 Rate Case
Recorded vs. Benchmark Efficiency Factors



PUC-IR-106
DOCKET NO. 2008-0083
ATTACHMENT 1
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HAWAIIAN ELECTRIC COMPANY, INC.
2009 Rate Case
Recorded vs. Benchmark Efficiency Factors

Month	Recorded Efficiency Factor	Benchmark Efficiency Factor	Sales HR Variance	Under-collection ($000)	Most Recent Incidents	Explanation of why could not meet Benchmark Efficiency Factor
Jan 07	0.011208	0.01117	0.000038	$ 192.0	12	Multiple reheat unit and IPP outages during K1 overhaul. Multiple FWH outage-H9 94 FWH, K5 53 FWH, W4 45 FWH, W6 64 FWH, and W8 83-85 FWHs.
Feb 07	0.011287	0.01117	0.000117	$ 476.6	11	Multiple reheat unit outages-W8 on K1. Multiple FWH outage-H9 94 FWH, K5 53 FWH, W4 45 FWH, W6 64 FWH, and W8 83-85 FWHs.
Mar 07	0.011066	0.01117	-0.000104	$ (183.3)		
Apr 07	0.011431	0.01117	0.000261	$ 835.4	10	Stacked reheat unit outages-K2, K4 on W7. Multiple FWH outage- H9 94 FWH, W6 64 FWH, W8 83-85 FWHs.
May 07	0.011075	0.01117	-0.000095	$ (83.3)		
Jun 07	0.011377	0.01117	0.000207	$ 1,041.3	9	Stacked reheat unit outages-K3, K5, W7. Severe derate and degraded boiler performance on K3. W3 24/7 Operations. Multiple FWH outage-H9 94 FWH, W6 64 FWH, W8 83-85 FWHs.
Jul 07	0.011443	0.01117	0.000273	$ 1,658.4	8	Stacked reheat unit outages-K5 on K3. W3 24/7 Operations. Multiple FWH outage-H9 94 FWH, W6 64 FWH, W8 83-85 FWHs.
Aug 07	0.011239	0.01117	0.000069	$ 602.0	7	W3 24/7 Operations. Multiple FWH outage-H9 94 FWH, W3 34 FWH, W6 64 FWH, W8 83-85 FWHs.
Sep 07	0.011241	0.01117	0.000071	$ 647.0	6	Stacked reheat unit outages-K2 on K3. W3 24/7 operations. Severe derate on K6. FWH Outage-H9 94 FWH, W3 34 FWH, W6 64 FWH, W8 83 FWH.
Oct 07	0.011079	0.01117	-0.000091	$ (190.6)		
Nov 07	0.011230	0.01117	0.000060	$ 493.4	5	Multiple FWH outages-H9 94 FWH, K1 14 FWH, K5 51 FWH, W3 34 FWH, W6 64 FWH. .W3 24/7 Operations due to startup transformer outage.
Dec 07	0.011012	0.01117	-0.000158	$ (589.2)		
Jan 08	0.010809	0.01117	-0.000361	$ (1,574.5)		
Feb 08	0.011027	0.01117	-0.000143	$ (514.0)		
Mar 08	0.011069	0.01117	-0.000101	$ (354.5)		
Apr 08	0.011031	0.01117	-0.000139	$ (470.7)		
May 08	0.010954	0.01117	-0.000216	$ (1,176.3)		
Jun 08	0.010937	0.01117	-0.000233	$ (1,352.7)		

HAWAIIAN ELECTRIC COMPANY, INC.
2009 Rate Case
Recorded vs. Benchmark Efficiency Factors

Jul 08	0.011153	0.01114	0.000013	$ 97.9	4	Less than $100K undercollection. No major generation cause identified.
Aug 08	0.011098	0.01114	-0.000042	$ (338.8)		
Sep 08	0.011050	0.01114	-0.000090	$ (768.0)		
Oct 08	0.011081	0.01114	-0.000059	$ (507.3)		
Nov 08	0.011098	0.01114	-0.000042	$ (284.2)		
Dec 08	0.011228	0.01114	0.000088	$ 470.3	3	Stacked reheat unit outages-K2 on K5. System-wide outage on 12/26.
Jan 09	0.011155	0.01114	0.000015	$ 57.8	2	Less than $100K undercollection. No major generation cause identified.
Feb 09	0.010883	0.01114	-0.000257	$ (654.2)		
Mar 09	0.010932	0.01114	-0.000208	$ (521.1)		
Apr 09	0.011024	0.01114	-0.000116	$ (218.6)		
May 09	0.011298	0.01114	0.000158	$ 484.4	1	Tank heel and diesel disposal due to Kahe FO Tank 11 cleaning. W7 75 FWH outage.
Jun 09	0.011039	0.01114	-0.000101	$ (211.6)		

PUC-IR-107

Reference: Act 162 (2006)
HECO ST-10B at 7
HECO ST-10B at 8 - 9

HECO filed Supplemental Testimony of Dr. Jeff D. Makholm, on Behalf of Hawaiian Electric Company, Inc. on July 20,2009. Dr. Makholm stated the following:

> The risk of fuel cost changes comprises two things:
> - Changes in the *price* of fuel as a single productive input; and,
> - Changes in the *cost* to deliver and produce electricity from HECO's fuel inputs. This reflects any changes in the technical ability of the utility to turn purchased fuel into electricity, which may require HECO to purchase a greater quantity of fuel, and thus increase the overall level of fuel costs, in order to produce the same amount of electricity.

Dr. Makholm explained that:

> The ECAC, with its "heat rate" efficiency factor... , provides a partial pass-through of fuel costs. It shares the costs and/or benefits of decreased or increased plant operating efficiency by tying HECO's ability to recover its fuel costs (and financial performance) to its power plant performance[.]

Please provide:
a) an explanation of how HECO fairly shares the risk of fuel cost changes with its customers if HECO responds to question (1) of PUC-IR-107 that there are no incidences where HECO could not reach heat rate efficiency factors in the past three years; and
b) procedures and related staff reports, records or logs to demonstrate that HECO monitors deteriorating heat rates so that HECO can take appropriate action to improve conditions. If the required reports, records or logs are voluminous, please provide computer files, instead.

HECO Response:

a. Not applicable. Although PUC-IR-107 part a. is not entirely clear, HECO assumes it refers to HECO's response to PUC-IR-106, part a., which asks for details of "historical incidents" or a month in which the sales heat rate exceeded the reference sales heat rate value , in the past three years or the past ten historical incidents, whichever shorter time frame is applicable. As stated in HECO's response to PUC-IR-106 the most recent ten historical incidents span back to April 2007, but because the data in Attachment 1 to the response to PUC-IR-106 is presented for the entire year of 2007, a total of 12 historical incidents are reflected in the Attachment 1 data.

However, it should be noted that the Company gains or loses financially from any respective reduction or increase in the system sales heat rate.

b. It should be noted that the generating system is not managed with the sole goal of minimizing the system-wide sales heat rate – the generating system (which includes independent power producers dispatched by HECO) is managed so as to try to assure that the system load is met, generating units are maintained on a regular basis, and system reliability is maintained – and within these constraints, so that fuel and purchased energy costs are minimized, and overall system costs (which include maintenance and capital costs) are minimized.

HECO monitors individual generating unit, power plant, and system heat rates for different periods including daily. Results are reported daily on an internal company "heat rate website" that is available to O&M personnel. Attachment 1 to this response shows representative pages of this website. E-mail reports summarizing heat rate issues are also sent out daily to selected personnel in the company. Attachment 2 is an example of these daily email reports. Heat rate status is also reported and discussed weekly at the Power Supply Vice President's staff meeting. Attachment 3 is an example of these weekly reports. Heat rate monitoring results are also presented monthly at the Periodic O&M meetings (which are generally conducted on a monthly basis). New Operator Trainees receive classroom instruction on heat rate during their first several weeks of employment.

Attachment 4 is a copy of the heat rate training presentation given to all new HECO Operator Trainees.

Procedurally it is important to avoid scheduling simultaneous maintenance outages of the generating units that have better heat rates. For example, HECO's base load units that have "reheat" steam cycles have better heat rates than cycling or peaking units. It is standard procedure to avoid scheduled maintenance outages of more than one base load generating unit whenever possible. Similarly, when forced outages of baseload units occur, the dates of the scheduled maintenance outages for other baseload units are generally adjusted.

The sales heat rate target is an annual system average, and the actual system-wide sales heat rate will vary from hour to hour, day to day, week to week, and month to month, as the factors that may impact the heat rate change. Some of the factors that affect the heat rate, and/or the financial impact, include:

(1) Fuel prices;

(2) Availability of purchased energy (AES, Kalaeloa, HPower):

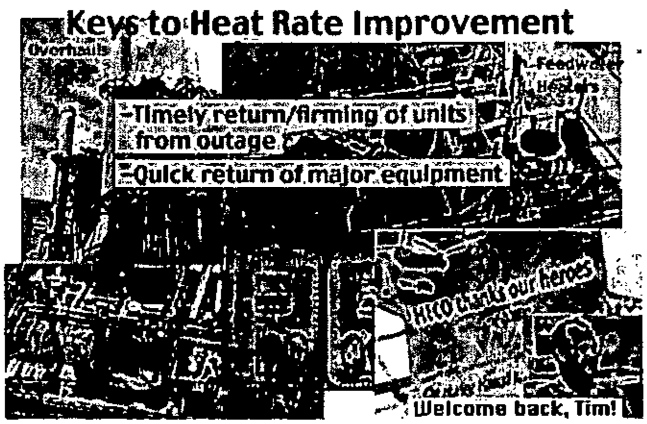
(3) Availability of HECO units, which are affected by scheduled outages (overhauls and maintenance outages), forced outages and deratings; and

(4) System load, which impacts how many units have to be run.

Preliminary 2004 Target-10,520 Btu/KWH
Report 1 2009 Year End Forecast-10,647 Btu/KWH

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

POWER SUPPLY
HEAT RATE
WEBSITE
Confidential
Updated Aug. 7, 2009
(Hit F11 for best viewing)



Heat Rate Goal Status		7/31/09
	Not Meeting Goal=>	
Min. (YTD)	10,700	
Target (YTD)*	10,650	
Max. (YTD)	10,600	
(in Btu/KWH)	Ideal=>	

Optimizing Boiler Conditions for Heat Rate

Blr. Impacts Cycl. Unit | Blr. Impacts Reheat Units

EPT Notes

Find out the impacts and get the class notes here.

Click Here!!

THE POWERPLANeT ONLINE

Website Links:

PlantView

Intranet EAF/Ht. Rt. Update

Power Supply Goals Report

Comments? Email Andy Here

HECO Heat Rate/Generation Summary Report - 8/7/09

The YTD heat rate through 7/31/09 was was 10,558 Btu/KWH, 92 Btu/KWH **below** the Report 1 Forecast/Target*. The YTD operational heat rate was 10,636 Btu/KWH.

As of 07/31/09	
Heat Rate-Btu/KWH	
Actual	10,558
Target	10,650
	(92)
Sales (Busbar)	-1.6%

The heat rate for July closed out at 10,701 Btu/KWH, 69 **above** the Forecast of 10,632, and 23 **below** the operational heat rate of 10,724 Btu/KWH.

2009 Sales (busbar generation) through the end of July were 1.6% **below** the Report 1 Target and 4.2% **below** the same period in 2008.

Weekly system heat rates have been running from the 10,500s to 10,800s Btu/KWH. The events impacting heat rate for the week ending 7/29/09+ are shown in **bold** in the **Active Events** tables below.

The Operational Heat Rate Variance for the most current completed week is shown below. Problematic units are shown in red. (Clicking on the unit number will take you to the unit's heat rate page.)

Weekly Unit Heat Rates

Current 7 Day Heat Rate Average				
Unit	*Net Ht. Rt.-Btu/KWH*	*Oper. HR Var.-Btu/KWH*	*Cost Impact per Day*	*Comments*
K1	10,144	(88)	$ (1,082)	-
K2	-	-	$ -	Unit on outage
K3	**10,021**	**203**	**$ 2,785**	**89 MW Blk, rht temp ctrl prob**
K4	10,090	(78)	$ (919)	80 MW Blk, high FD fan amps
K5	**9,885**	**43**	**$ 879**	**140 MW Blk, drum level**
K6	9,936	(247)	$ (4,693)	-
W7	10,010	(615)	$ (7,132)	-
W8	-	-	$ -	Unit on outage
W3	12,938	(1,426)	$ (3,525)	-
W4	12,264	(365)	$ (1,391)	47 MW Blk, air limited
W5	11,666	(892)	$ (3,227)	50 BW Blk, high APH out Temp
W6	11,521	(592)	$ (2,855)	-
H8	12,314	(400)	$ (1,070)	-
H9	12,804	(352)	$ (837)	94 FWH out
Week ending 07/29/09				

Active events impacting heat rate are shown below:

Active Events Tables

Unit	Active Events	Start	End	Estimated Cost Impact-Additive
K2	**Overhaul**	**5/30/09**	**Ongoing**	**$ 3552/Day**
W8	**Outage**	**7/19/09**	**Ongoing**	**$ 12766/Day**
K3	**Blocked at 89 MW (-1 MW), reheat attemp. limit**	**4/15/09**	**Ongoing**	**$ 2232/Day**
K4	**Blocked at 80 MW (-9 MW), high FD Fan amps**	**6/3/09**	**Ongoing**	
K5	**Blocked at 140 MW (-2 MW), drum level control**	**7/18/09**	**Ongoing**	
W4	**Blocked at 47 MW(-2 MW), air limited**	**11/3/08**	**Ongoing**	**$ 1424/Day**
W5	**Blocked at 50 MW (-7 MW), high AH gas out temp**	**6/30/09**	**Ongoing**	
W5/6	**24/7 Operations at Night**	**7/19/09**	**Ongoing**	**$ 366/Day**

Unit	Active Events - Equipment Out Longterm	Start	End	Estimated Cost Impact
H9	94 FWH out due to leak (95 FWH drips into condenser), when online	8/4/05	?	$ 1022/Day

Details on the status of feedwater heaters can be found here:

FMRS (FIFO) assignment of fuel energy content (HHV) at Kahe/Waiau/Honolulu has adversely affected system heat rate for this year by 43 Btu/KWH.

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

Report | Goal Status | Impacts/Ranking | Initiatives | Event Log

Power Supply Department Goal Status-(5 ACHIEVING/2 NOT ACHIEVING)

Seven department subgoals were set to help us achieve the Target heat rate goals. The results are shown below.

Variance Between Actual and Operational Heat Rates - NOT ACHIEVING

Operational Heat Rate Variance (Actual - Operational) in Btu/KWH	
Actual	(78)
Target	(100)
7/31/09	

This goal measures how well our units in total are performing versus Targeted unit efficiencies that account for actual hourly loadings of our system. Hence, this shows how well we are operating and maintaining our units. The lower the number the more efficient we are.

Operational Heat Rate Variance (Actual - Operational) in Btu/KWH		
Station	Actual	Target
Honolulu	(290)	
Kahe	134	
Waiau	(514)	
Waiau CT	(1,196)	
TOTAL	(78)	(100)
7/31/09		

The Operational heat rate Variance Goals is - 100 Btu/KWH for HECO system. Waiau and Honolulu Stations are performing better than Targeted. Note that the Variances use FMRS derived fuel, heat content.

Heat Rate Improvement after Major Unit Overhauls - ACHIEVING

The goal is measured by the average change in daily, Operational Heat Rate Variances for each unit and weighted by the maximum capability of the unit. K5 will have the highest impact and H8 the least impact to this goal.

Heat Rate Improvement After Overhauls - 2009		
	Actual	Target
K5	2.2%	2.0%
K6	3.2%	2.6%
K2		2.0%
K1		2.0%
Average (Weighted by Max. MW)	2.7%	2.3%
7/31/09		

Average Feedwater Heater Outage Days - ACHIEVING

Feedwater Heater Outages	Avg. Days Out per Occurrence
Actual	6.5
Target	11.0
8/5/09	

The goal is to get our feedwater heaters back into service as quickly as possible. The clock runs only when the unit is online and a fuel penalty is occurring. Currently, the H9 94 FWH is out of service.

Average Heater Drip Pump Outage Days - ACHIEVING

Heater Drip Pump Outages	Avg. Days Out per Occurrence
Actual	1.3
Target	4.0
8/5/09	

Ensuring quick return of heater drip pumps is critical. Its outage means that hot condensate is wasted by its return to the condenser rather than being pumped into the high pressure feedwater heaters. Again, like the FWH outage goal, the clock only runs when there is a fuel penalty.

Condenser Backpressure Variance on Reheat Units - NOT ACHIEVING

The backpressure variance shows how well are condensers are performing. Currently, we are not achieving this goal. A lower variance is better.

The backpressure variances for the individual units are shown.

Condenser Performance Goal Status	Backpressure Change-in Hg
K1	0.26
K2	0.21
K3	(0.02)
K4	(0.40)
K5	(0.14)
K6	(0.12)
W7	0.10
W8	0.10
Total	**-0.02**
Target	**-0.20**
8/5/09	

Excess O2% Variance on Reheat Units - ACHIEVING

Excess O2% Goal Status (MW Weighted)	% O2 Variance from Target
Actual	**(0.04)**
Target	**0.00%**
7/31/09	

We are meeting this goal. This number is MW weighted so units contributing higher generation have a bigger impact on this number.

Excess O2% Goal Status (MW Weighted) Unit	% O2 Variance from Target
K1	0.45
K2	0.26
K3	0.92
K4	0.20
K5	0.32
K6	-1.09
KAHE	0.23
W7	-1.12
W8	-0.81
WAIAU	-0.96
Total	**-0.04**
Target	**- 0.00%**
7/31/09	

Auxiliary Power Consumption Variance - ACHIEVING

Auxiliary Power Consumption Variance	% Change from Target
Actual	**-2.2%**
Target	**- 0.0%**
7/31/09	

The goal was based upon auxiliary MW curves used in the ABCs in the Report1 Forecast. Unit results are shown in the following table. Higher than expected consumption is shown in red.

This is a measurement of how we operate and maintain our auxiliary equipment used to generate steam/electricity. The best way we can achieve this goal is to turn on auxiliary equipment when we need to and turn it off when we don't. The largest auxiliary equipment that impacts this goal is the usage of boiler feedwater pump.

Auxiliary Power Consumption Variance Unit	% Change from Target	Comments
H8	**0.7%**	Worse
H9	**5.0%**	Worse
K1	-4.2%	Good
K2	-7.9%	Good
K3	-5.1%	Good
K4	-3.8%	Good
K5	**1.8%**	Worse
K6	**5.7%**	Worse
W3	**11.3%**	Worse
W4	-16.7%	Good
W5	-2.6%	Good
W6	-2.5%	Good
W7	-6.5%	Good
W8	-5.1%	Good
TOTAL	[illegible]	Good

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

Report | Goal Status | Impacts/Rankings | Initiatives | Event Log

Heat Rate Ranking

Year To Date, Heat Rate Ranking of Units

Unit Heat Rate Rankings-YTD		
Rank	Unit	Heat Rate-Btu/KWH
1	W8	9,877
2	K5	10,032
3	K3	10,050
4	K4	10,141
5	K1	10,142
6	W7	10,164
7	K6	10,199
8	K2	10,224
9	W6	11,907
10	W5	11,985
12	W4	12,352
11	H8	12,511
13	H9	12,790
14	W3	13,414
7/31/09		

Best Operating Reheat Unit-YTD		
Rank	Unit	Oper. HR Var. Btu/KWH
1	W7	(554)
2	W8	(505)
3	K1	(132)
4	K6	(117)
5	K4	(97)
6	K2	(33)
7	K5	145
8	K3	200
7/31/09		

Best Operating Cycling Unit-YTD		
Rank	Unit	Oper. HR Var.-Btu/KWH
1	W3	(1,283)
2	W4	(774)
3	W6	(751)
4	W5	(607)
5	H8	(236)
6	H9	(198)
7/31/09		

Rankings based upon flows measured and fuel heat content estimated by Coriolis flowmeters.

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

SYSTEM HEAT Rate/Indicators

- Actual vs Forecast Heat Rate
- -Cummulative YTD
- Actual vs Operational Heat Rate
- -Cummulative YTD
- Sales (Net to system, busbar)
- Excess Cycling Unit Hours (Daily)
- Fuel Cost Tracking (Monthly)

Honolulu Station

Station Heat Rate
- -Act. vs Forec.
- -Act. vs Oper.

H8 H9

Kahe Station

Station Heat Rate
- -Act. vs Forec.
- -Act. vs Oper.

K1 K3 K5
K2 K4 K6

Waiau (Steam) Station

Station Heat Rate
- -Act. vs Forec.
- -Act. vs Oper.

W3 W5 W7
W4 W6 W8

Waiau Combustion Turbines

CT Heat Rate
- -Act. vs Forec.
- -Act. vs Oper.

W9 W10

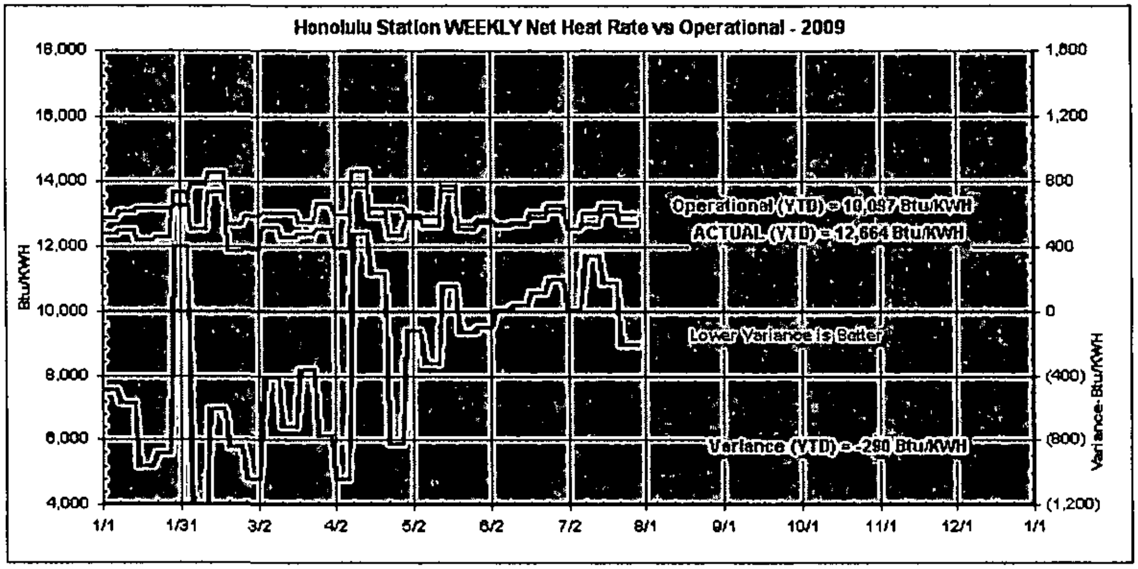
HECO Distributed Generator Units

Monthly Heat Rate

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

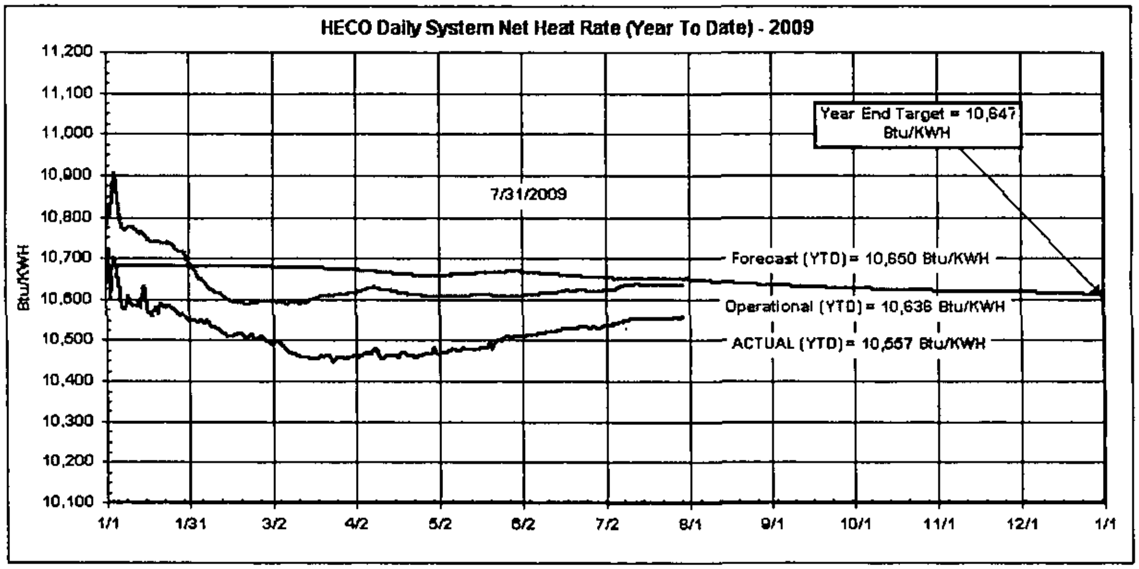
YEAR TO DATE STATISTICS	Honolulu	7/31/09				
GENERATION		NET HEAT RATE		ESTIMATED FUEL COSTS		
Gross KWH	107,195,700	Actual	12,664	Actual	$	10,781,334
Net KWH	97,737,600	Operational	12,954	Expected	$	11,028,132
Aux KWH	9,458,100	Variance	(290)	Cost Impact	$	(246,798)



Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

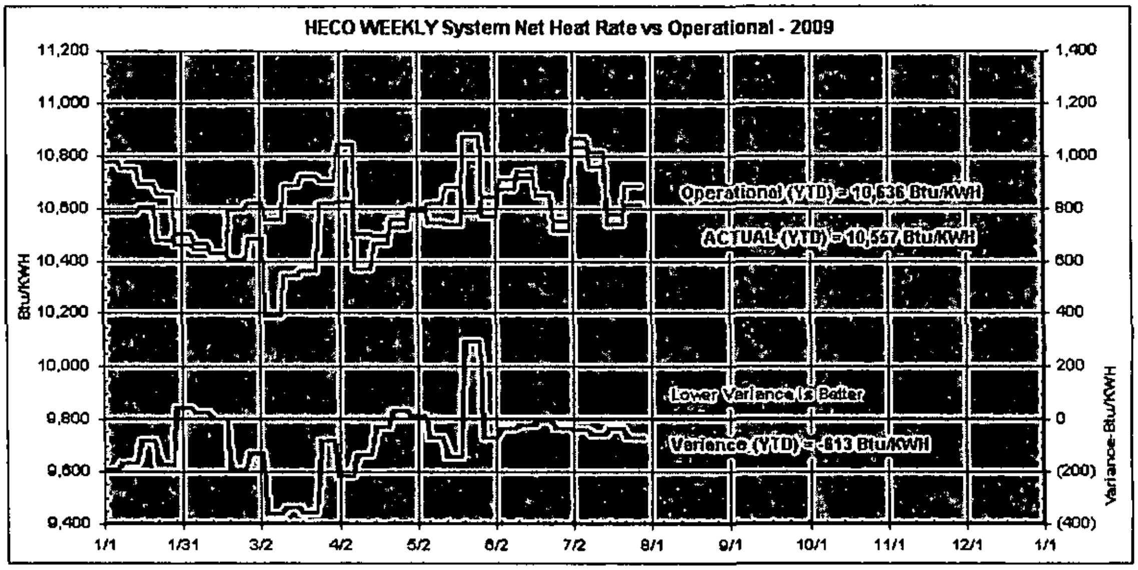
YEAR TO DATE STATISTICS		System	7/31/09		
GENERATION		NET HEAT RATE		ESTIMATED FUEL COSTS	
Gross KWH	2,721,060,609	Actual	10,558	Actual	$ 221,466,081
Net KWH	2,561,205,969	Operational	10,636	Expected	$ 223,100,961
Aux KWH	159,854,640	Variance	(78)	Cost Impact	$ (1,634,880)



Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

YEAR TO DATE STATISTICS		System	7/31/09		
GENERATION		**NET HEAT RATE**		**ESTIMATED FUEL COSTS**	
Gross KWH	2,721,060,609	Actual	10,558	Actual	$ 221,466,081
Net KWH	2,561,205,969	Operational	10,636	Expected	$ 223,100,961
Aux KWH	159,854,640	Variance	(78)	**Cost Impact**	$ (1,634,880)

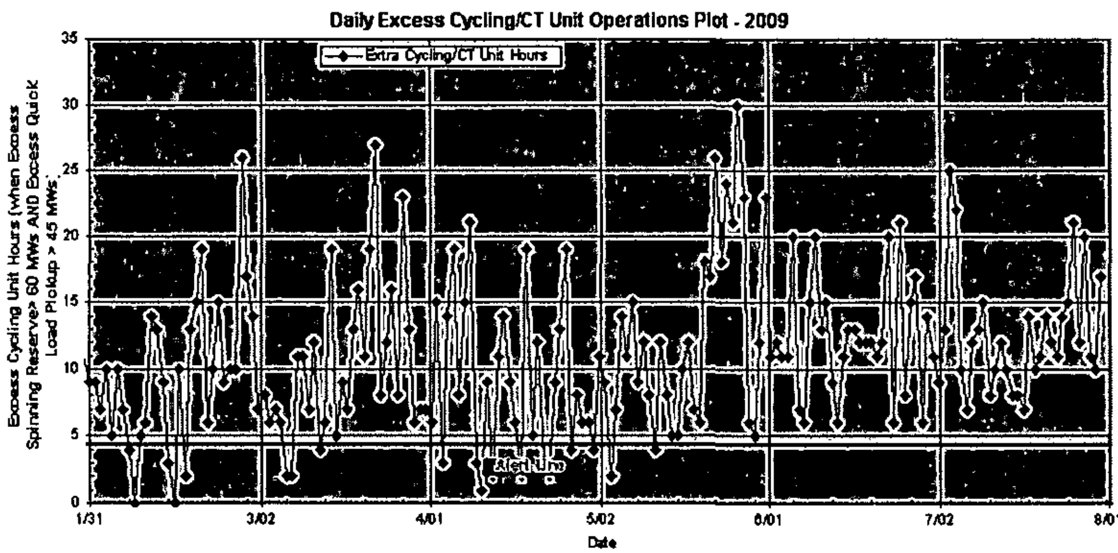


Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

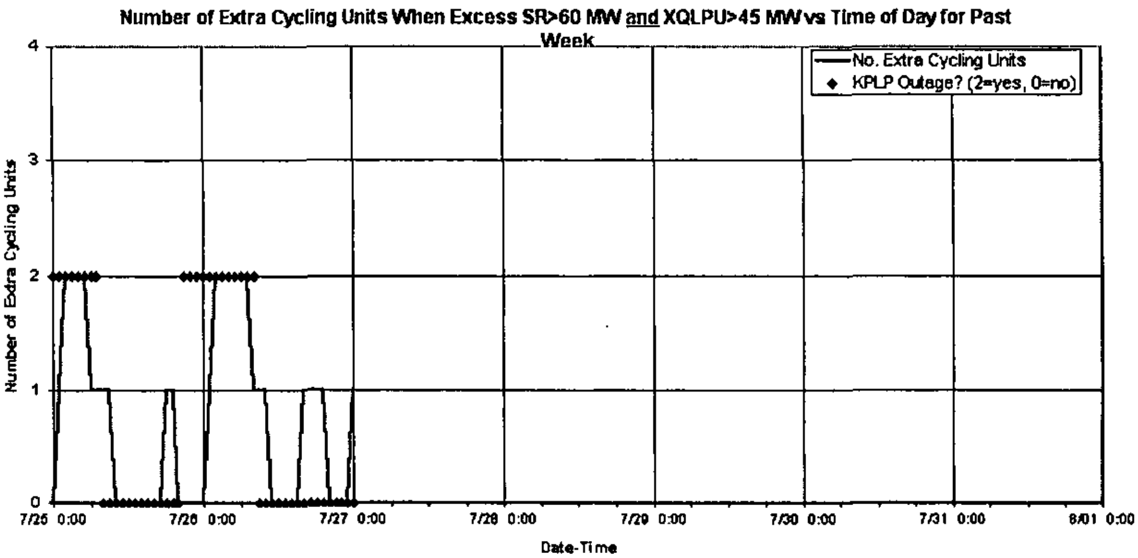
The plots on this page have data from both the old EMS and the new EMS beginning 3/27/06.

Daily Excess Cycling/CT Unit Operations Check-Total Estimated Hours Shown



Each extra hour a cycling unit is run and not needed cost us about $368/Hr per Unit

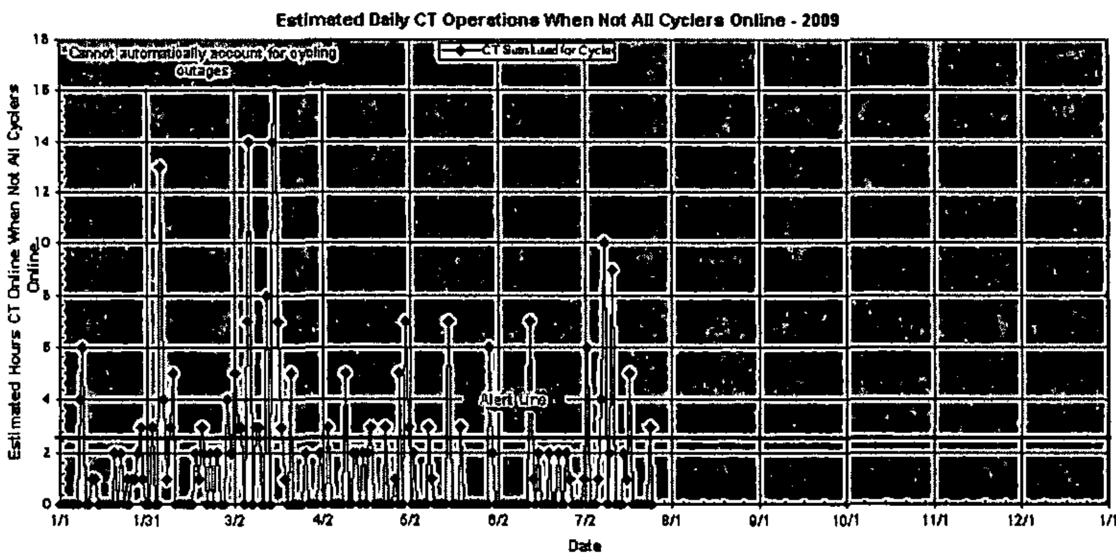
Past Week-Detailed, Daily Excess Cycling/CT Unit Operations



The above plot shows the times of the day when excess spinning reserve > 60 MW, excess quick load pickup > 45 MW, and a cycling or CT unit was online. Sixty MW is the capacity of our largest cycling unit.

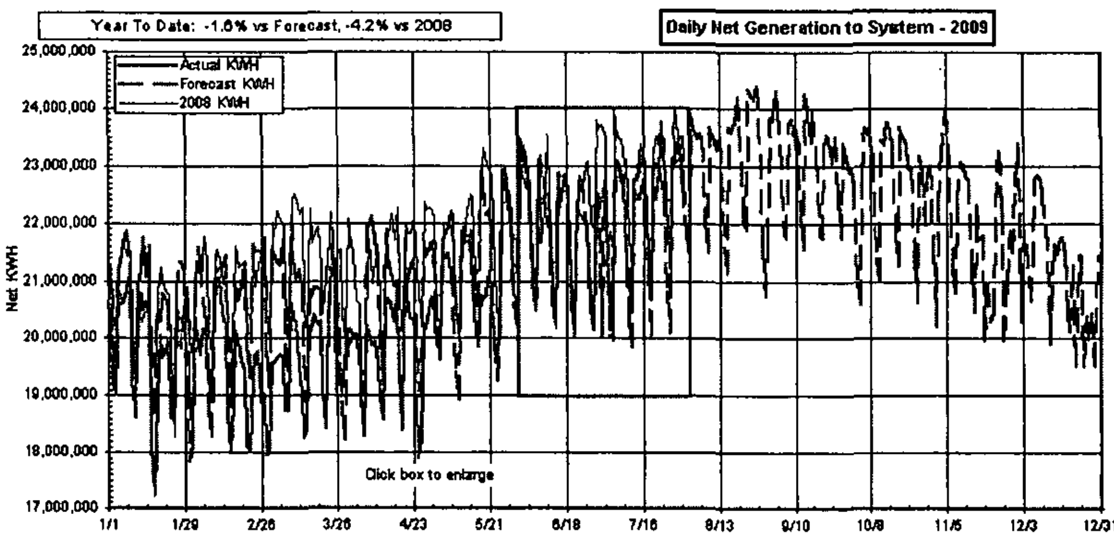
Note: Spinning reserve is the additional capability carried above the system demand, typically the capability of the largest unit which is AES or K5/6 when AES is offline. KPLP is considered 2 x 90 MW units.

Daily Excess CT Unit Operations



Sales (Busbar Generation, Net to System) in KWH From daily generation stats	January	February	March	April	May	June	Note:
				07/31/09			
Actual	619,386,121	546,919,303	609,265,851	596,080,076	657,376,256	663,546,308	Actual and 2008 KWH generation from FMRS and Daily Power System Operation Logs
Forecast	628,378,800	574,726,200	632,803,400	619,434,700	656,671,200	657,924,000	
2008	635,980,596	585,312,617	665,746,273	637,432,184	673,780,975	669,366,009	
% Difference							IPP Generation is a mix of DGR & PI data
Actual vs Forec.	-1.43%	-5.01%	-3.72%	-3.77%	0.11%	0.85%	
Actual vs 2008	-2.61%	-6.73%	-8.48%	-6.49%	-2.44%	-0.87%	

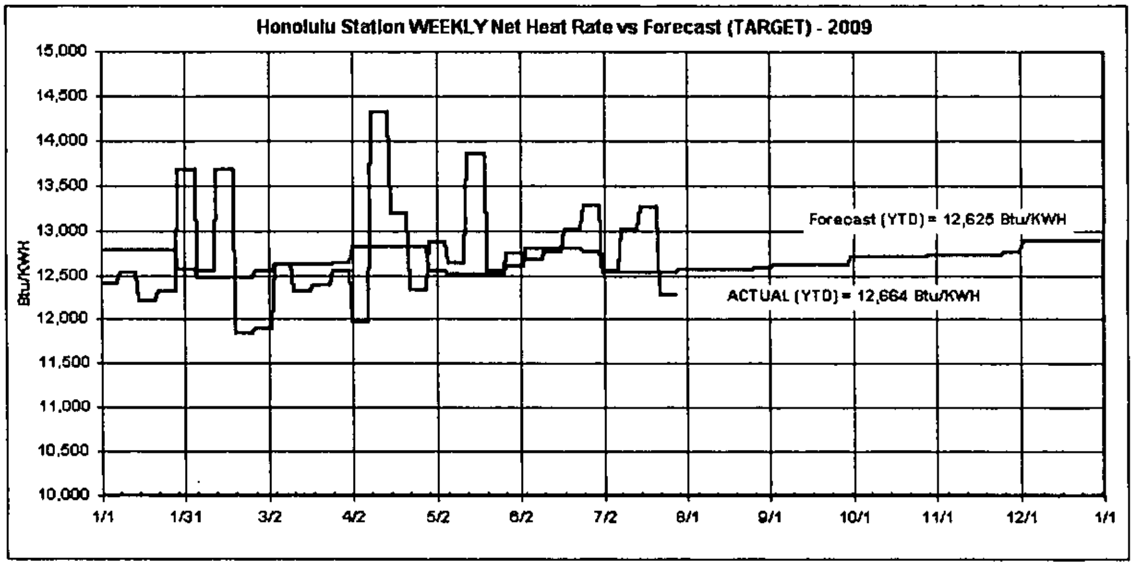
	July	August	September	October	November	December	Total
Actual	691,031,315	0	0	0	0	0	4,382,602,230
Forecast	684,214,300	0	0	0	0	0	4,454,152,600
2008	704,959,627	0	0	0	0	0	4,572,586,282
% Difference							
Actual vs Forec.	1.00%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	-1.61%
Actual vs 2008	-1.98%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	-4.15%



Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

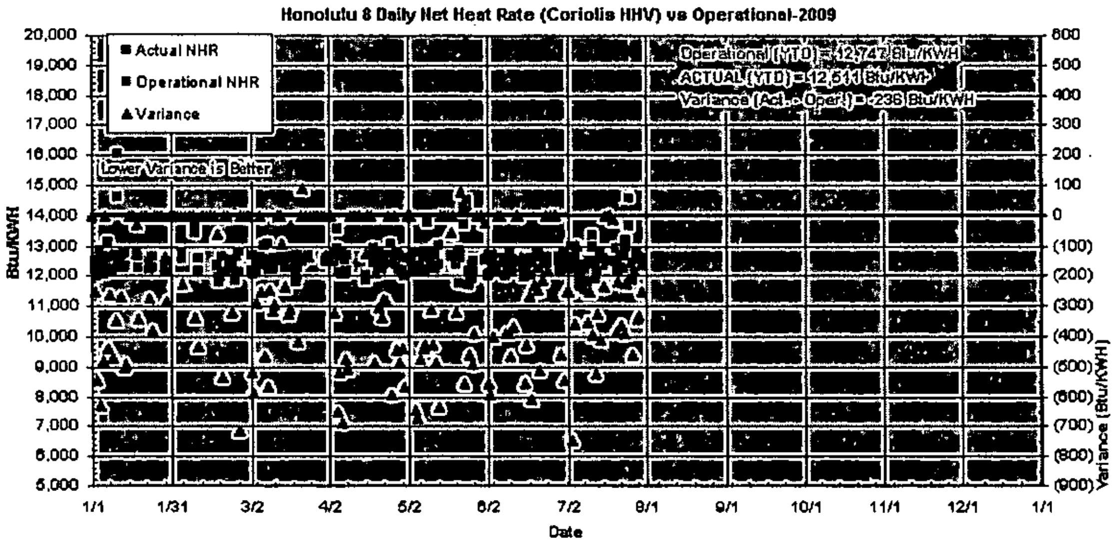
YEAR TO DATE STATISTICS		Honolulu	7/31/09			
GENERATION		NET HEAT RATE		ESTIMATED FUEL COSTS		
Gross KWH	107,195,700	Actual	12,664	Actual	$	10,781,334
Net KWH	97,737,600	Operational	12,954	Expected	$	11,028,132
Aux KWH	9,458,100	Variance	(290)	Cost Impact	$	(246,798)



Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

YEAR TO DATE STATISTICS		Honolulu 8	7/31/09			
GENERATION		**NET HEAT RATE**		**ESTIMATED FUEL COSTS**		
Gross KWH	51,456,300	Actual-Coriolis HHV	12,511	Actual	$	5,127,289
Net KWH	47,073,100	Operational	12,747	Expected	$	5,223,977
Aux KWH	4,383,200	Variance	(236)	Cost Impact	$	(96,688)
ESTIMATED HOURS ONLINE		2004				

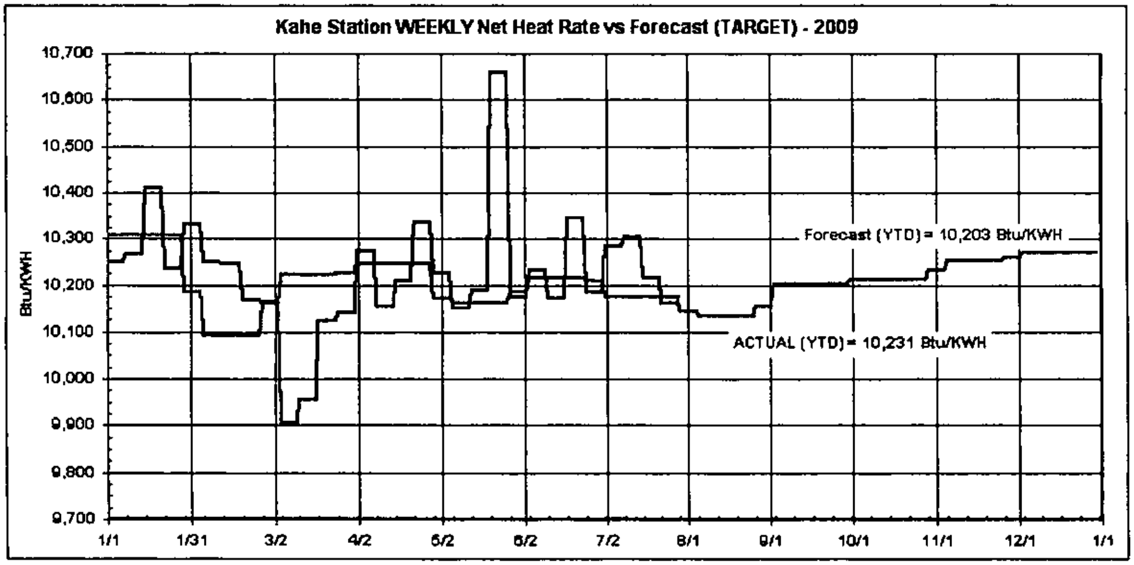


2006 Target Heat Rates: H8/9 | W3/4 | W5/6 | K1/2 | K3/4 | K5/6 | W7/8 | W9/10

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

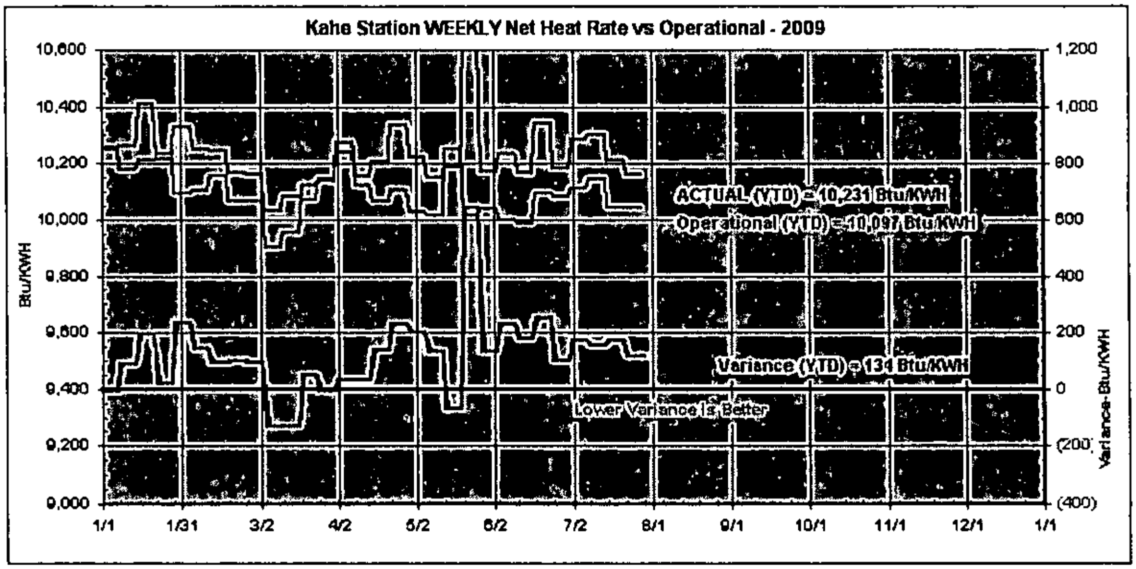
YEAR TO DATE STATISTICS		Kahe	7/31/09		
GENERATION		**NET HEAT RATE**		**ESTIMATED FUEL COSTS**	
Gross KWH	1,784,406,000	Actual	10,231	Actual	$ 138,594,627
Net KWH	1,681,221,400	Operational	10,097	Expected	$ 136,781,662
Aux KWH	103,184,600	Variance	134	**Cost Impact**	$ 1,812,964



Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

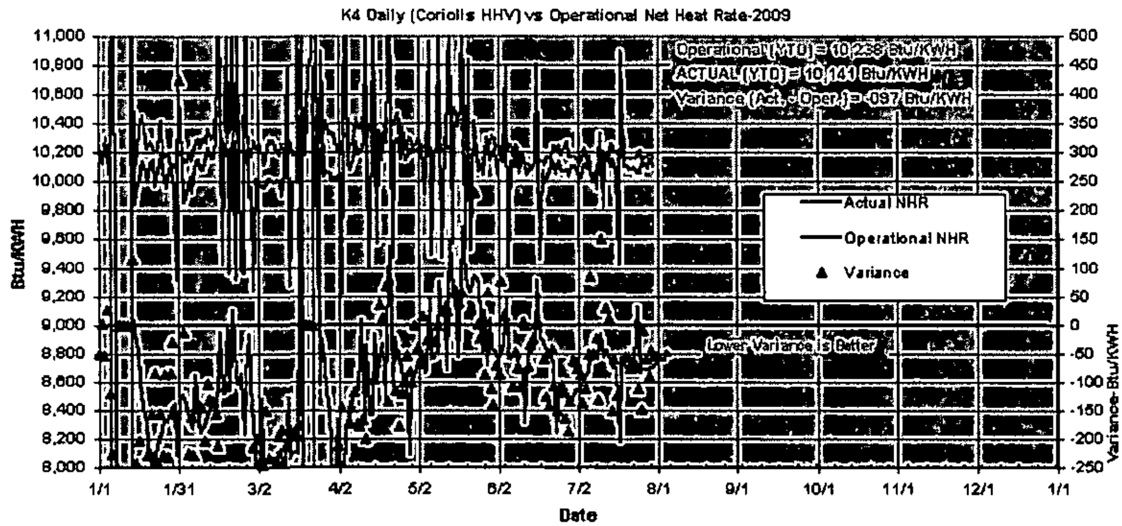
YEAR TO DATE STATISTICS		Kahe	7/31/09		
GENERATION		NET HEAT RATE		ESTIMATED FUEL COSTS	
Gross KWH	1,784,406,000	Actual	10,231	Actual	$ 138,594,627
Net KWH	1,681,221,400	Operational	10,097	Expected	$ 136,781,662
Aux KWH	103,184,600	Variance	134	Cost Impact	$ 1,812,964



Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

YEAR TO DATE STATISTICS		Kahe 4	7/31/09			
GENERATION		NET HEAT RATE		ESTIMATED FUEL COSTS		
Gross KWH	286,097,000	Actual-Coriolis HHV	10,141	Actual	$	22,034,366
Net KWH	271,010,000	Operational	10,238	Expected	$	22,245,215
Aux KWH	15,087,000	Variance	(97)	Cost Impact	$	(210,849)
ESTIMATED HOURS ONLINE		4792				

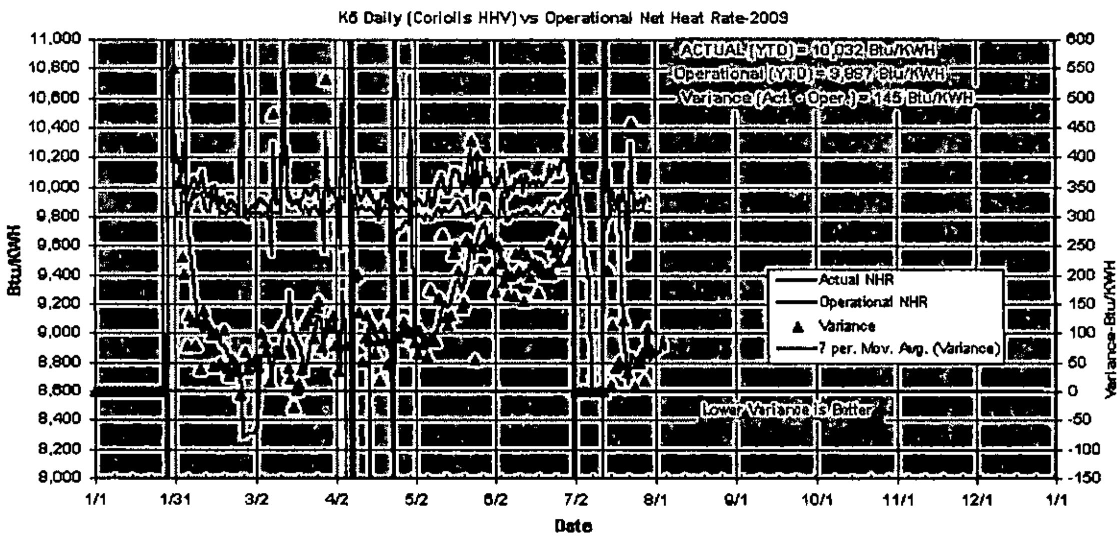


2006 Target Heat Rates: H8/9 | W3/4 | W5/6 | K1/2 | K3/4 | K5/6 | W7/8 | W9/10

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

YEAR TO DATE STATISTICS		Kahe 5	7/31/09			
GENERATION		NET HEAT RATE		ESTIM.FUEL COSTS		
Gross KWH	445,970,000	Actual-Coriolis HHV	10,032	Actual	$	31,519,994
Net KWH	418,066,000	Operational	9,887	Expected	$	31,063,174
Aux KWH	27,904,000	Variance	145	Cost Impact	$	456,820
ESTIMATED HOURS ONLINE		4067				



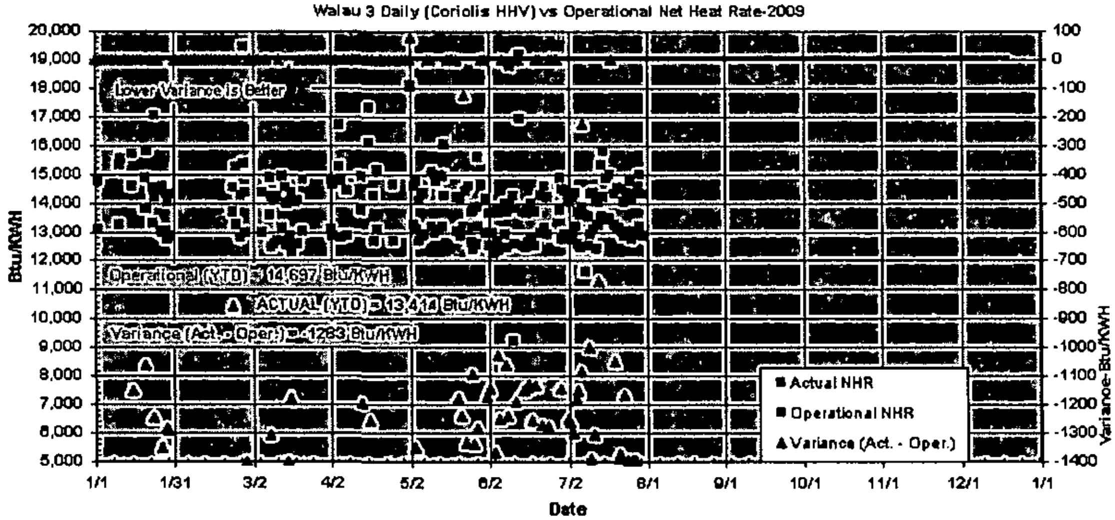
2006 Target Heat Rates: H8/9 | W3/4 | W5/6 | K1/2 | K3/4 | K5/6 | W7/8 | W9/10

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

System | Honolulu | Kahe | Waiau | CT

YEAR TO DATE STATISTICS		Waiau 3	7/31/09			
GENERATION		NET HEAT RATE		ESTIMATED FUEL COSTS		
Gross KWH	38,706,400	Actual-Coriolis HHV	13,414	Actual	$	3,697,177
Net KWH	34,391,800	Operational	14,697	Expected	$	4,050,739
Aux KWH	4,314,600	Variance	(1,283)	Cost Impact	$	(353,562)
ESTIMATED HOURS ONLINE		1546				

Waiau 3 Daily (Coriolis HHV) vs Operational Net Heat Rate-2009



2006 Target Heat Rates: H8/9 | W3/4 | W5/6 | K1/2 | K3/4 | K5/6 | W7/8 | W9/10

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

Auxiliary KWH Usage

Honolulu
-H8/9

Kahe
-K1/2
-K3/4
-K5/6

Waiau
-W3/4
-W5/6
-W7/8

Reheat Air Heater Monitoring

Kahe
-K1/2
-K3/4
-K5/6

Waiau
-W7/8

Summary

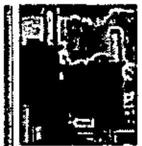
Condenser Monitoring

Honolulu
-H8/9

Kahe
-K1/2
-K3/4
-K5/6

Waiau
-W3/4
-W5/6
-W7/8

Summary



Cycling Unit Fire-ups

Monthly Table

Reheat Excess O2% Monitoring

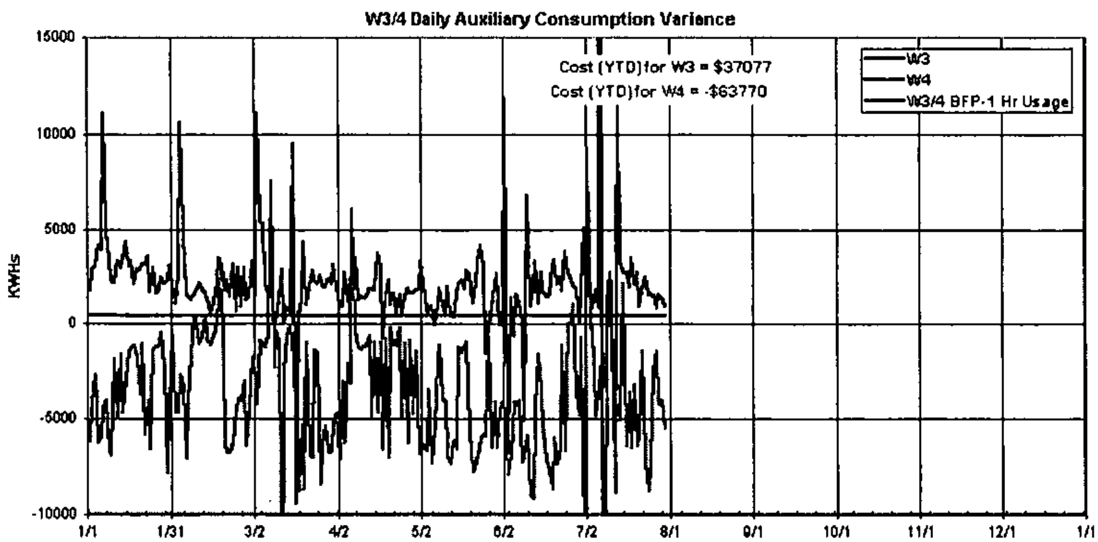
Kahe
-K1/2
-K3/4
-K5/6

Waiau
-W7/8

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

Aux KWH Usage | Cycling Unit Fire-up | Air Heater | Condenser | Excess O2%

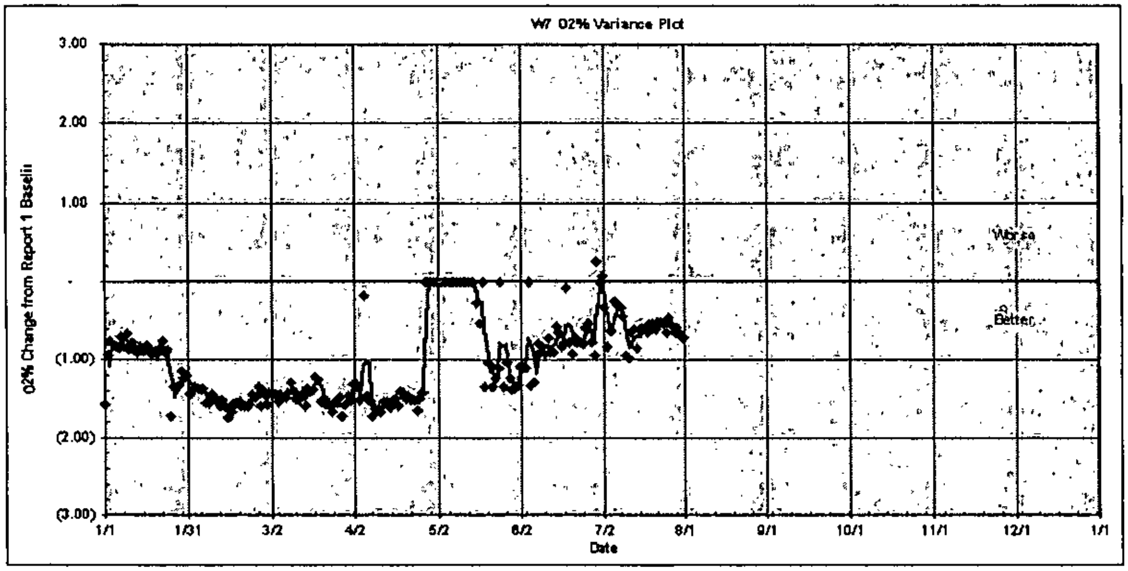
2006 Auxiliary MW Target Curves H8/9 | W3/4 | W5/6 | K1/2 | K3/4 | W7/8 | K5/6



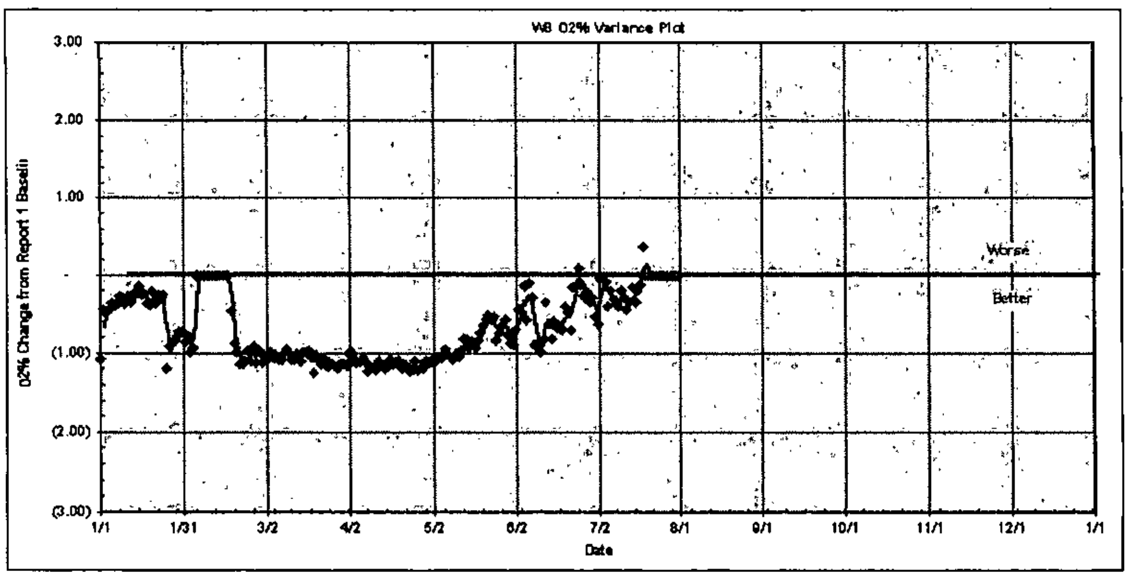
Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

Aux KWH Usage | Cycling Unit Fire-up | Air Heater | Condenser | Excess O2%

Excess O2% Monitoring



2005 Excess O2% Target Curves K1/2 K3/4 K5/6 W7/8



Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

Processbook/PI System

PI System Training

Fundamentals of the PI System

Using Processbook and Datalink

Troubleshooting Common Processbook/Datalink Problems

OSI Video-Processbook Basics

OSI Video-Datalink Basics

2004 OSIsoft Users Conference

Powerpoint Slide Summary

Conference Diary-detailed notes in Word Format

Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations by US-Canada Power System Outage Task Force (Referenced at conference, pdf format)

Securing the PI Historian by EPRI (Referenced at conference, pdf format)

2005 OSIsoft Users Conference

Conference Diary-detailed notes in Word Format

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

Statistical Reports

Summary of System & Station Heat Rate, Generation, and Fuel Usage by Month

Monthly Heat Rate Statistics-System Operations Reporting

Monthly Department of Health Unit Fuel Consumption - Updated 8/7/09

Daily Net KWH Generation-Excel Spreadsheet

Historical Generation/Heat Rates for Stations/Units

Latest EMS ABC Curves Used for Economic Dispatch-1/8/07

Heat Rate/Incremental Cost Plots

How does Economic Dispatch Work?

Report 1 Overhaul Schedule - as of 7/21/06

2007

Approved Overhaul Schedule Folder

Summary | Heat Rate | Parametric Monitoring | Processbook | Stats-Data | Other | HELP

INFOSESSIONS-Heat Rate Presentations

November/December 2004 INFOSESSION

May 2004 INFOSESSION

Fall 2005 INFOSESSION

Summer 2006 INFOSESSION

Comparison Study of Coriolis Flowmeter Fuel Consumption vs FMRS

Status of Reheat Unit Boiler Feedwater Pump Recirculation Valves (update in progress)

Impact of Open Turbine Drain Valves

K6 Drains on Turbine Extraction Lines

W8 Drains on Steam Chest Lines Going Into Nozzle Blocks

Heat Rate Help/Primer Page

What is Heat Rate?

Why Heat Rate?

What Impacts Heat Rate (or what can I do to improve heat rate)?

How Do We Measure/Track/Benchmark Heat Rate?

How do I calculate my unit's heat rate?

What Does Actual/Forecast or Target/Operational Heat Rate Mean?

What are the **Heat Rate Impact Items** and What are their Magnitudes?

Operations Impacts

Maintenance Impacts

System Impacts (Impact of Overnight Cycling Unit Operations)

How do I calculate heat rate or cost impacts?

Where can I learn More on How to Improve Heat Rate?

What Technology Are We Using to Improve Heat Rate?

What generating units do we have at each of HECO's Stations and what types of units are they?

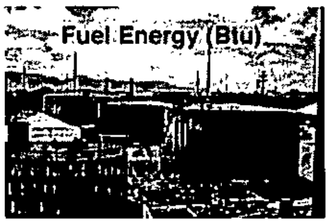
Honolululu Station Kahe Station Waiau Station

What does a typical reheat unit look like? What are the flow paths for steam, feedwater, oil. etc.?

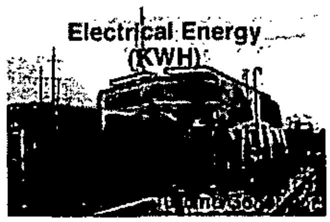
What is Heat Rate?

- Measurement of efficiency , it is simply the amount of fuel energy consumed, in British Thermal Units to produce a Kilowatt-Hour. So it is the ratio of what we put in(fuel energy) to what we get out(electrical energy).* This is shown in the Figure 1 below

Heat Rate = Fuel Energy to Electrical Energy



to



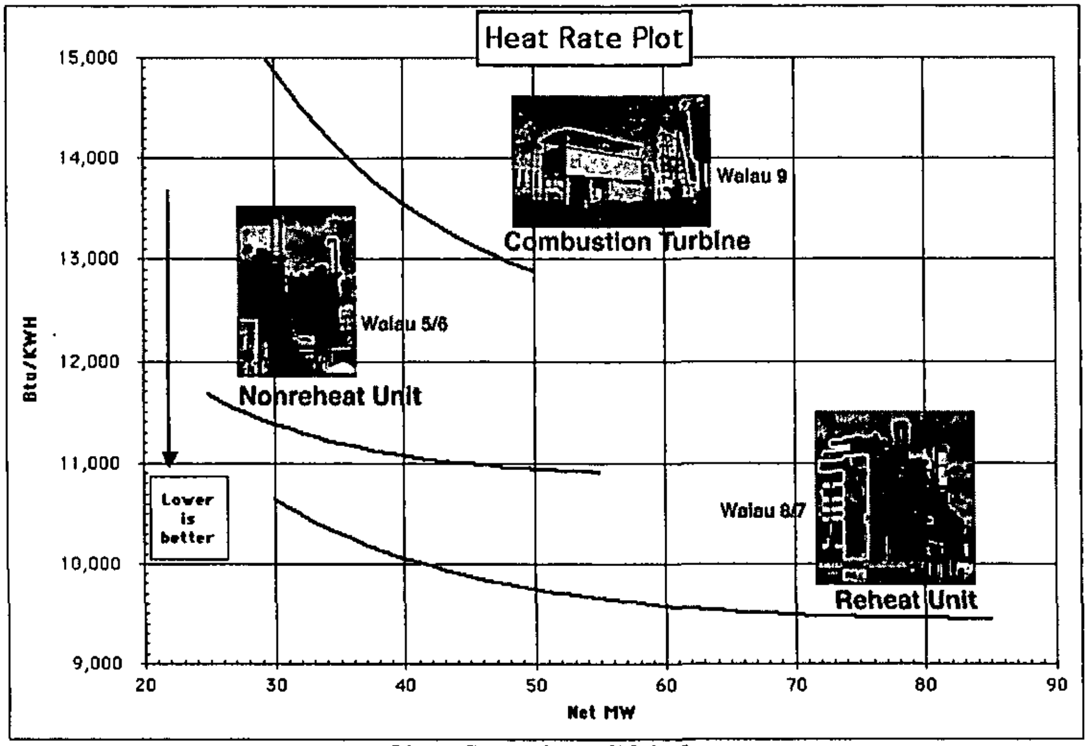
or in equation form

$$\text{Heat Rate} = \frac{\text{Fuel Energy in Btu}}{\text{Electrical Generation in Kilowatt Hours}}$$

Figure 1 Heat Rate Equation

- We always refer to it on a NET basis , that is, Kilowatt-Hours are measured NET of auxiliary consumption.
- Lower is BETTER.
- Higher unit loads means lower heat rate and higher efficiency.
- Reheat units are the most efficient followed by the nonreheat units and then combustion turbines. Therefore, we always want to run our reheat units first and then nonreheat units and combustion turbines.

These points are illustrated in the Plot 1 below.



Plot 1-Comparison of Unit Heat Rates

The heat rate plots show how heat rate varies from low to higher loads and that reheat units are significantly more efficient than nonreheat units and combustion turbines. Therefore, to lower the heat rate for the entire system-for all running HECO units, we would want to run our reheat units first than nonreheat units later and as a last resort-the combustion turbines.

Heat rate can also be measured on a larger basis. The heat rate statistics for 2000 are shown in the Table 1 below. The table shows that as a utility we consume and generate a tremendous amount of energy.

2000 Heat Rate Statistics			
Station	Fuel Energy Consumed British Thermal Units	Electrical Generation Net KilowattHours	Heat Rate Btu/KWH
Honolulu	1,015,995,250,000	68,924,800	14,741
Waiau Stm	11,878,420,760,000	1,065,105,600	11,152
Kahe	33,947,951,750,000	3,343,137,300	10,155
CT	127,639,930,000	3,877,550	32,918
System(Total)	46,970,007,690,000	4,481,045,250	10,482

Table 1 Heat Rate Statistics

Using the heat rate equation above, we can easily calculate the heat rate for the System, which includes all of HECO's generating units, as shown below.

-Heat Rate Calculation for System in 2000

$$\text{Heat Rate} = \frac{\text{Fuel Energy in Btu}}{\text{Electrical Generation in Kilowatt Hours}}$$

$$\text{Heat Rate} = \frac{46{,}970{,}007{,}690{,}000 \text{ Btu}}{4{,}481{,}045{,}250 \text{ KWH}}$$

$$\text{Heat Rate} = 10{,}482 \text{ Btu/KWH}$$

*Heat Rate can be converted to % efficiency that we are all familiar with. The typical efficiency we're more familiar with is the ratio of what we get out to what we put in.

So since Heat Rate is (Energy In/Energy Out)...and if we "flip" Heat Rate we get...

$$\text{Efficiency} = \frac{1}{\text{Heat Rate}}$$

or

$$\frac{1}{(\text{Energy In/Energy Out})}$$

or

$$\frac{\text{Energy Out}}{\text{Energy In}}$$

and multiplying this by 3413 Btu/KWH and 100%...we have...

$$\text{Efficiency \%} = \frac{1 \times 3413 \times 100\%}{\text{Heat Rate}}$$

So if we have a heat rate of 10,000 Btu/KWH... our Efficiency % is 34%.

From: Ho, Andy W.K. (HECO)

Sent: Friday, August 14, 2009 3:31 PM

To: Ching, Dan; Francis, Violet; Goo, Mathew; Higashi, Debbie; Ishikawa, Shari; Joaquin, Tom; Kageura, Harold; Kobuke, Keith; Kwok, Tom; Lee, Henry; Mizumura, Dean; Nakamura, Della; Okunami, Peter; Ontai, Susanna; Saunders, Ward; Seto, Kimberly; Shigeta, Craig; Simmons, Tom; Vargo, Frank; Young, Robert; zz$Environmental-JA; zz$Environmental-JB; zz$Environmental-JC; zz$Environmental-JW; zz$FD-IA; zz$FD-IF; zz$FD-IJ; zz$P&E-YA; zz$P&E-YC; zz$P&E-YE; zz$P&E-YF; zz$P&E-YG; zz$P&E-YJ; zz$P&E-YM; zz$P&E-YP; zz$PowerSupplyO&M-IB; zz$PowerSupplyO&M-IH; zz$PowerSupplyO&M-IK; zz$PowerSupplyO&M-IL; zz$PowerSupplyO&M-IM; zz$PowerSupplyO&M-IN; zz$PowerSupplyO&M-IP; zz$PowerSupplyO&M-IT; zz$PowerSupplyO&M-IW; zz$PowerSupplyO&M-IX

Subject: Daily 2009 HECO Heat Rate/Generation, EFOR/EAF Update-8/14/09

Daily 2009 HECO Heat Rate/Generation, EFOR/EAF Update

August 14, 2009

Power Supply Process Area

In This Issue

- Year to Date Heat Rate
- Weekly Heat Rate
- EFOR/EAF
- **How can we improve on heat rate?**
- **How can we improve on this report?**

2009 Heat Rate Website Links

Heat Rate Website

Summary Report

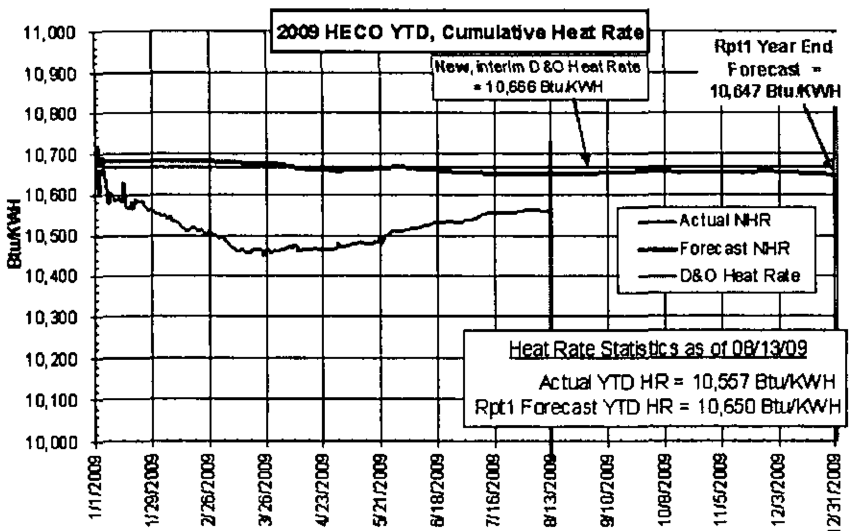
Department Goal Status

Event Log

Heat Rate

Year to Date Heat Rate

As of 8/13/09, the **Actual heat rate of 10,557 Btu/KWH** is lower than the **Report 1 Forecast of 10,650 Btu/KWH** by **(93) Btu/KWH.**



Weekly Heat Rate

Help

System Operations

Daily Generation Report

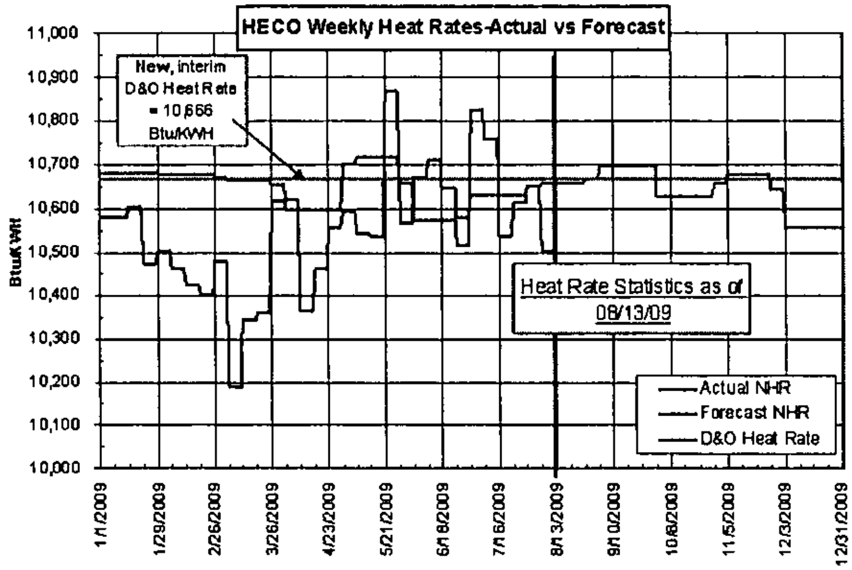
Daily System Load Graph

System Operations Website

Contact Us

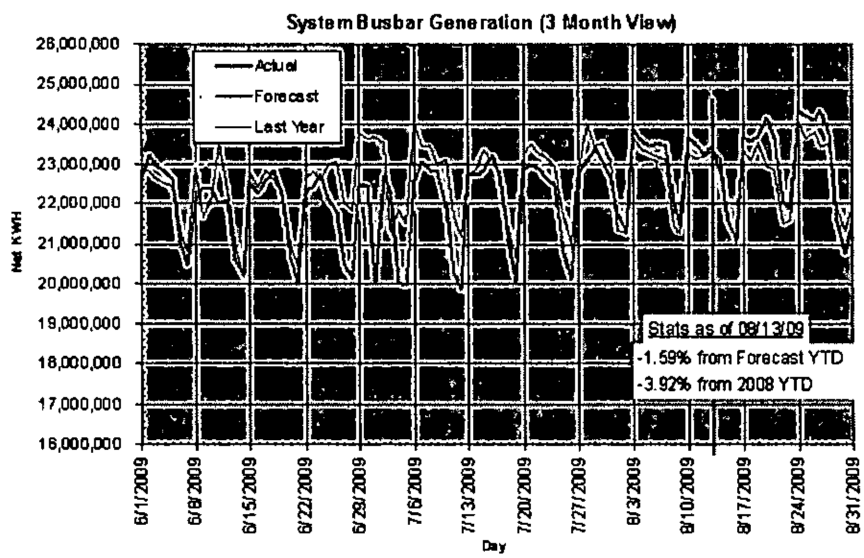
Heat Rate- Andy Ho (x 4294) or Richard Wang (x 7248)

EAF/EFOR- Shane Uemoto (x4115)

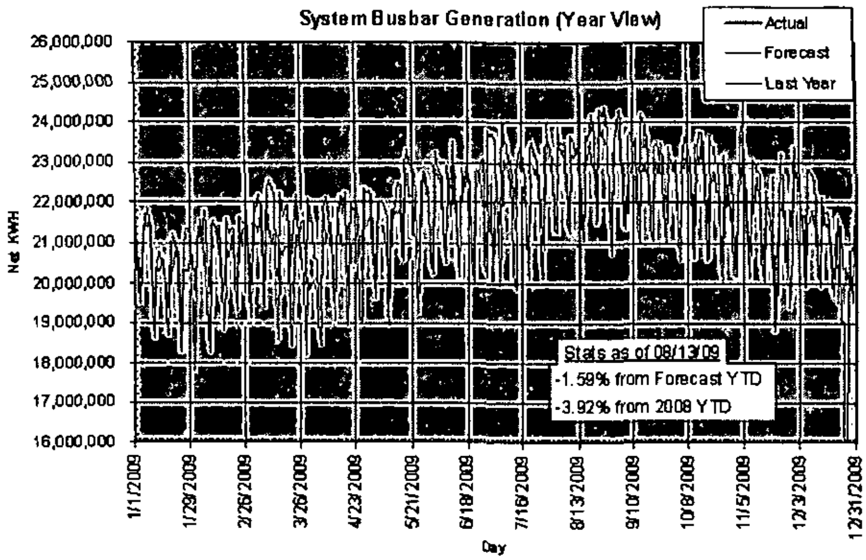


Daily System Busbar Generation (Net, HECO + IPPs)

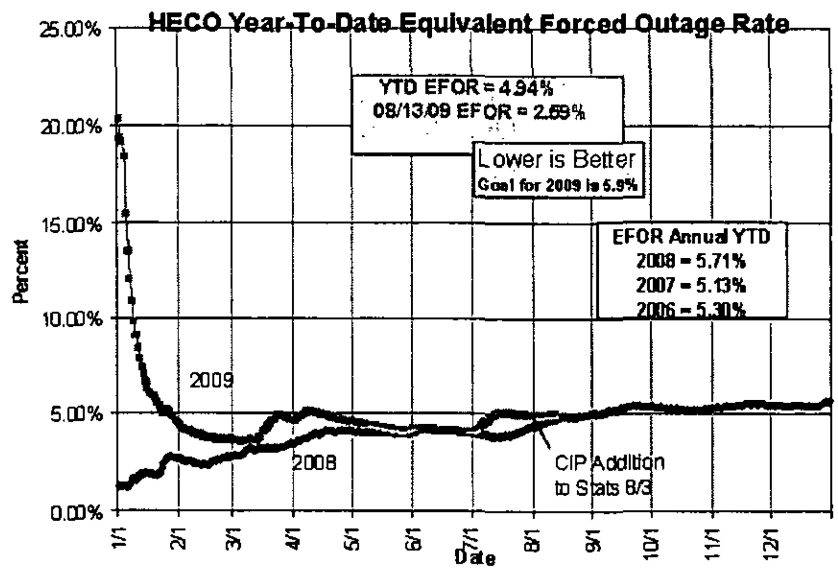
3 Month View

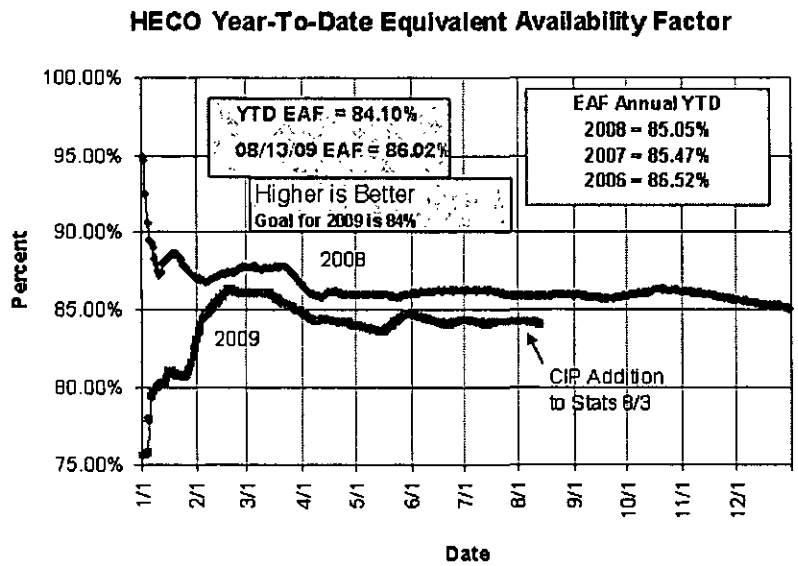


Year View


System Busbar Generation (Year View)
Actual
Forecast
Last Year
Net KWH
Day
Stats as of 08/13/09
-1.59% from Forecast YTD
-3.92% from 2008 YTD

EFOR/EAF


HECO Year-To-Date Equivalent Forced Outage Rate
YTD EFOR = 4.94%
08/13/09 EFOR = 2.69%
Lower is Better
Goal for 2009 is 5.9%
EFOR Annual YTD
2008 = 5.71%
2007 = 5.13%
2006 = 5.30%
2009
2008
CIP Addition to Stats 8/3
Percent
Date



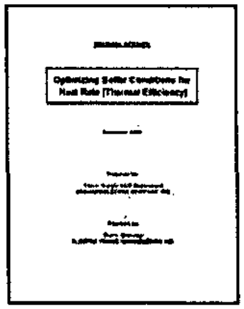
How Can We Improve Heat Rate? By Improving Boiler Operations.

Managing Boiler Operations-Minimizing Excess O2% while Being Environmentally Compliant

We can improve unit efficiency by managing our excess O2% on our boilers while ensuring that we don't exceed permitted emissions. Too much excess O2% will result in unnecessary heat losses out of the stack and additional electrical usage to run our fans harder. Plus to maintain rated boiler temperatures, will cause us to use cooler feedwater (attemperation) more than we need to and this is another heat rate impact. A 1% increase in excess O2% alone results in an additional **$85 to $550/day in fuel costs**.

Want a real example? Over 2 days (4/30-5/1) our Operators at **Kahe 5/6** have reduced Excess O2% on K5 from 3% to 2.2% at 140 MW. They dropped superheat attemperation by 16 KLb/Hr and reheat attemperation by 6 KLb/Hr while dropping air heater gas out temperatures by 6 Degr. F. FD Fan amps dropped 11 amps per side. This in total reduced K5's heat rate by 60 Btu/KWH and saves $806/Day. GREAT JOB GUYS!

Want to learn more on how to operate your boiler controls to save on heat rate and managing your emissions? Class notes from **EPT's Optimizing Boiler Conditions for Heat Rate** (taught by a famous manager) are just a click away **here** on the Heat Rate Website. Or click on the EPT's document below.



Optimizing Boiler Conditions for Heat Rate (Click on Icon)

How Can We Improve On This Report?

This report has been published since March of 2006 in its current format. Candid comments are welcome to improve it. So please let us know what you think-positive or negative! You can email your feedback by clicking the link below.

Click here for Feedback Link

Daily HECO Heat Rate & EFOR/EAF Update
T. Simmons Staff Meeting

August 11, 2009 Power Supply Process Area

In This Issue

- Year-to-Date Heat Rate
- Weekly Heat Rate/ Busbar Generation
- EFOR/EAF
- How can we improve heat rate ?

2009 Heat Rate Website & Other Links

Heat Rate Website

Summary Report

Department Goal Status

Event Log

PI Unit HR Monitoring

Heat Rate Help

Overhaul Schedules Folder

Latest EMS ABC I/O Curves

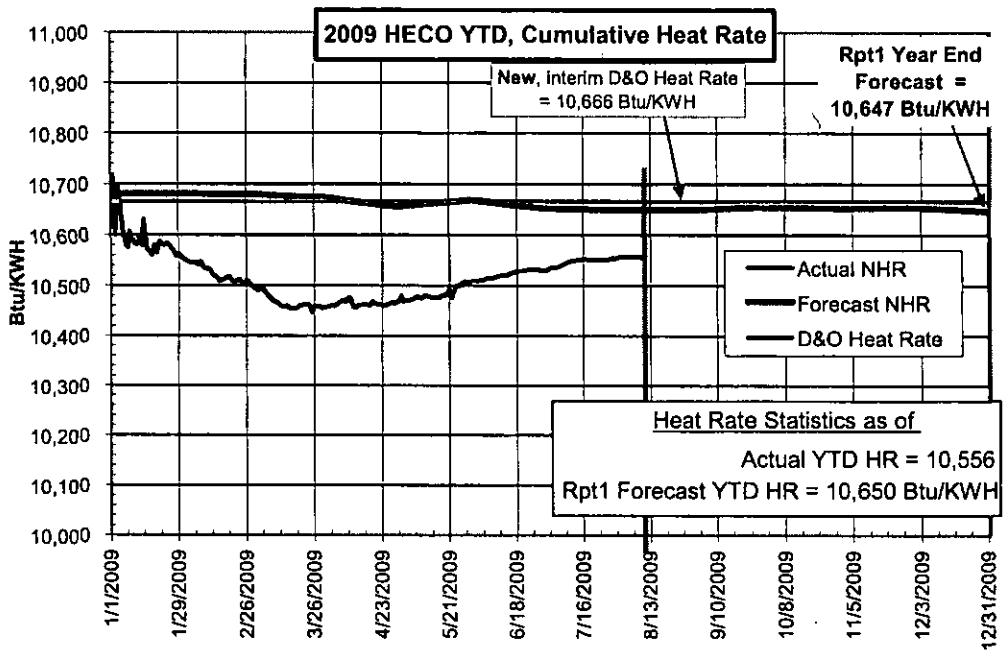
System Operations

Daily Generation Report

Daily System Load Graph

Year-to-Date Heat Rate

As of 8/10/09 the **Actual heat rate of 10,556 Btu/KWH** is lower than the **Report 1 Forecast of 10,650 Btu/KWH** by **(94) Btu/KWH**. At the last meeting, the variance as of 8/3 was reported at (96) Btu/KWH. (A new interim D&O of 10,666 Btu/KWH went effective on 10/22/07. A final D&O of 10,602 Btu/KWH for 2005 went effective on 6/20/08. The final D&O allows for full recovery of DG fuel expenses and is not subject to a fixed heat rate.)



The above results reflect FMRS data YTD through 7/31 and PI results 8/1+ (CIP included from 7/30+)

Weekly Heat Rate/Busbar Generation

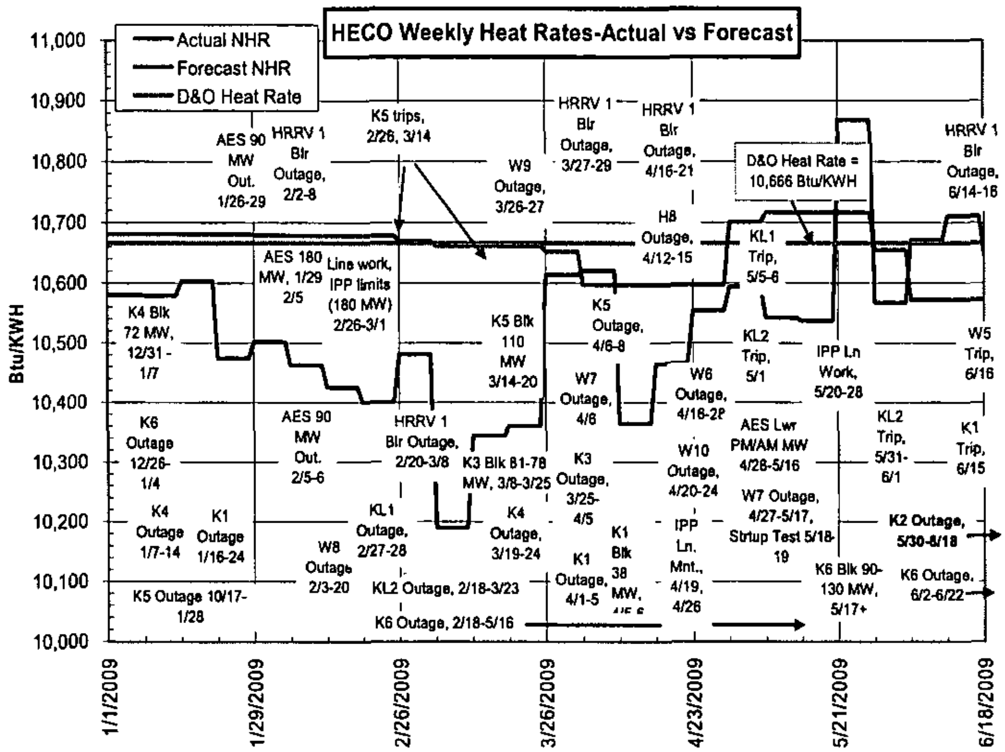
First Half of 2009 Weekly Heat Rate Plot

System Operations Website

Contact Us

Heat Rate- Andy Ho (x 4294) or Richard Wang (x 7248)

EAF/EFOR- Shane Uemoto (x 4115)



Second Half of 2009 Weekly Heat Rate Plot

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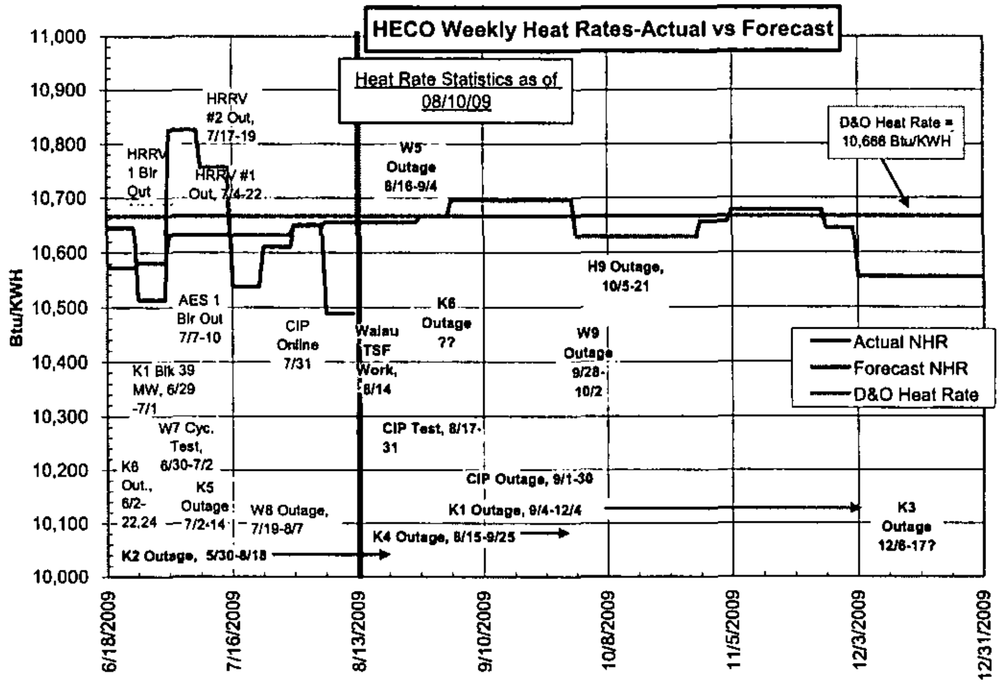


Weekly heat rates have averaged in the 10,500-10,600 Btu/KWH range for the most recent weeks. The return of W8 should result in daily heat rates to drop below 10,500 Btu/KWH but expect heat rates to pickup when K4 goes on outage along with CIP testing.

For the month of July, the **FMRS Recorded** heat rate closed out at **10,701 Btu/KWH**, above the **Forecast** of **10,632 Btu/KWH** by 68 Btu/KWH. The **Operational heat rate** for this period was **10,724 Btu/KWH**. FMRS is assigning a much higher heat content than is being burnt (Coriolis flowmeter). The impact exceeds 1% or is resulting in a 110 Btu/KWH higher heat rate.

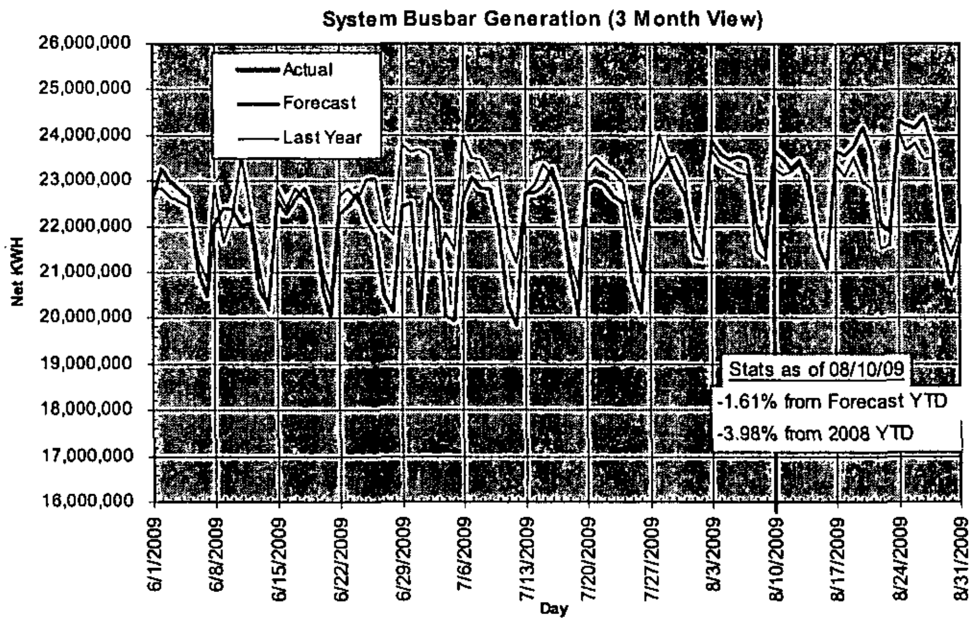
As of 7/31, the **Operational heat rate variance** was (78) Btu/KWH and (121) Btu/KWH from FMRS and via Coriolis HHV, respectively. (Note that the sum of the variances do not equal the total.)

YTD Operational Heat Rate Variance (Actual - Operational) in Btu/KWH		*As of 07/31/09*
Station	*Actual-FMRS*	*Via Coriolis HHV*
Honolulu	(290)	(256)
Kahe	134	63
Waiau	(514)	(505)
Waiau CT	(1,196)	(1,196)
HECO	**(78)**	**(121)**

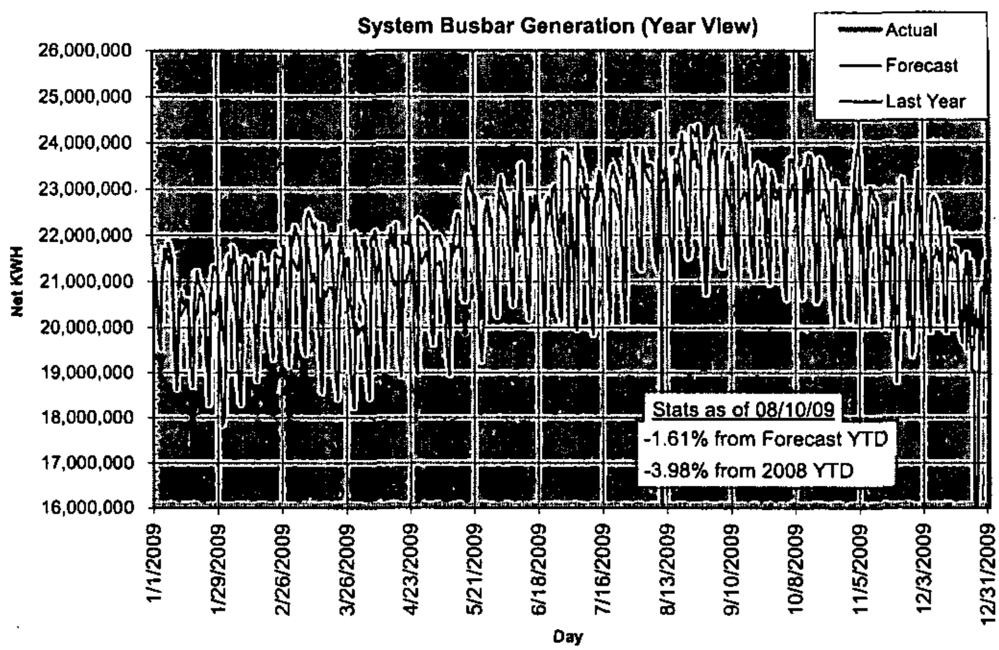
"Sales" (busbar generation) as of 8/10 were 1.6% below forecast and below same time last year by 4.0% on a YTD basis. Sales in the past week have averaged 2.2% and 0.8% below Forecast and the same period last year, respectively.

Moving 3 Month 2009 Busbar Generation Plot

[redacted]



Full Year 2009 Busbar Generation Plot



Active Events Impacting Heat Rate

- See Heat Rate Website (August 2009 EMS Costs)

Unit	Active Events	Start	End	Estimated Cost Impact-Additive
K2	Overhaul	5/30/2009	Ongoing	$ 11131/Day
W8	Heater Drip Pump Out of Service	8/7/2009	Ongoing	$ 2350/Day
K3	Blocked at 89 MW (-1 MW), reheat attemp. limit	4/15/2009	Ongoing	
K4	Blocked at 80 MW (-9 MW), high FD Fan amps	6/3/2009	Ongoing	
W4	Blocked at 47 MW(-2 MW), air limited	11/3/2008	Ongoing	
W5	Blocked at 50 MW (-7 MW), high AH gas out temp	6/30/2009	Ongoing	

The cost impacts were estimated using heat rate impact tables.

Unit	Active Events - Equipment Out Longterm	Start	End	Estimated Cost Impact
H9	94 FWH out due to leak (95 FWH drips into condenser), when online	8/4/2005	?	$ 1264/Day

- FWH Outage Status-S. Haynes
- **Condenser Backpressure Variances** Status as of 8/2/09 (Sunday)

Reheat Backpressure Variances			
Unit	Date of Update	Current BP Var.(in Hg.)	Est. Cost Impact ($/Day)
K1	8/9/09	0.21	$ 843
K2	8/9/09	-	$ -
K3	8/9/09	(0.02)	$ (85)
K4	8/9/09	(0.53)	$ (2,095)
K5	8/9/09	(0.22)	$ (792)
K6	8/9/09	(0.19)	$ (602)
W7	8/9/09	(0.00)	$ (10)
W8	8/9/09	0.31	$ 1,177

The current total cost impact is ($2499) per day (7 day average) penalty vs baselines. All ClO2 systems are now in operation at Kahe/Waiau. The W8 heater drip pump is out of service so drips from the 83-85 FWHs feed into the condenser.

The new ClO2 system at Kahe was put in operation on 4/3/08. The new ClO2 for Waiau was put in service on 8/1/08. The Kahe ClO2 system was out of operation from 12/21/08 to late May 2009.

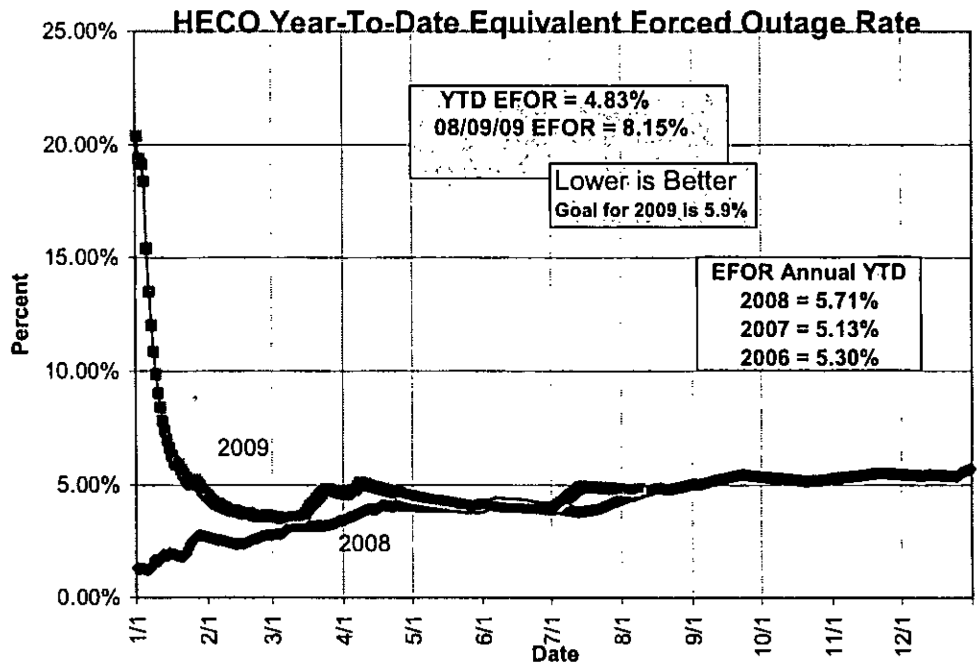
Fuel Cost Impact/YE Heat Rate Estimate

- Latest Financial Impact (Pre-tax) due to Heat Rate Variance as of 7/31/09 are:
    - o Based Upon Actual, Monthly Fuel Prices - ($1,962k) at $51.60/Bbl;
    - o Based Upon Report1 Forecast Fuel Prices - ($4,554k) - $122.25/Bbl.
    - o The Recorded heat rate is at 10,558 Btu/KWH vs the Forecasted 10,650 Btu/KWH.
    - o YTD Fuel expenses are at $222 million.
    - o YTD Busbar cost (fuel expense only) is 8.65 cents/KWH..

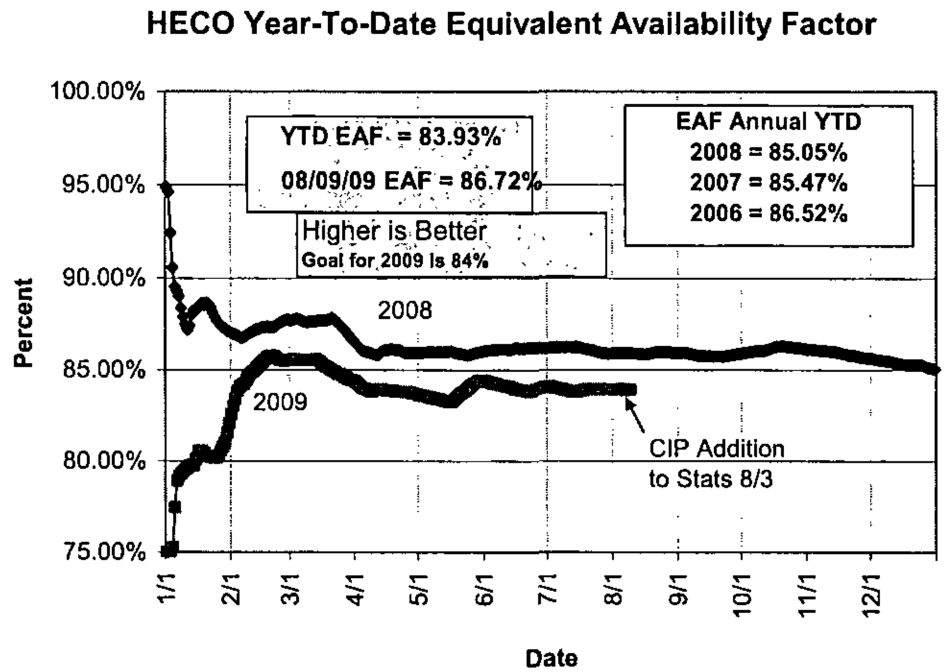
[redacted]

- Rpt 1 forecast for 2009 is 10,647 Btu/KWH, projected YE heat rate is 10,578 Btu/KWH.

EFOR/EAF



The events impacting EFOR on 8/9 (Sunday) were the forced outage on H9 and forced derates on K3, K4, W4, and W5.

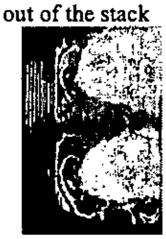


The events impacting EAF on 8/9 were the previous EFOR events and the scheduled outage on K2..

How Can We Improve Heat Rate?

<u>Watch Excess O2% & Emissions and Maintain Rated Boiler Temperatures!</u>

We can improve unit efficiency by managing our excess O2% on our boilers while ensuring that we don't exceed permitted emissions. Too much excess O2% will result in unnecessary heat losses out of the stack and into the atmosphere and additional electrical usage to run our fans harder. Plus to maintain rated boiler temperatures, this will cause us to use cooler feedwater (attemperation) more than we need to and this is another heat rate impact. A 1% increase in excess O2% results in an additional **<u>$234 to $1396/day in fuel costs</u>**. Want to learn more on how to operate your boiler controls? Class notes from <u>EPT's Optimizing Boiler Conditions for Heat Rate</u> (taught by a very famous manager) are just a click away here.



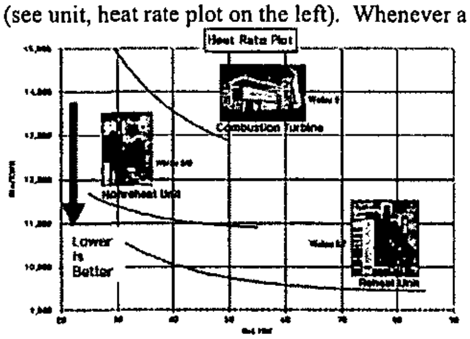
<u>Get Them Back in Service!</u>

Returning critical equipment, like feedwater heaters and heater drip pumps, back to service as quickly as possible will improve heat rate. When a unit is online and a feedwater heater is out of service, we spend an additional **<u>$575 to $5824 per day</u>** in fuel costs. For example, the outage of the W5 55 FWH is costing us about $560 per day in additional fuel costs when W5 is online.

[redacted]

Online and Firm!

Our most efficient units are our **reheat** units followed by our **nonreheat** and **combustion turbine** units (see unit, heat rate plot on the left). Whenever a reheat unit is offline or derated, a less efficient nonreheat or combustion turbine unit must come online to make up for the lost capacity. This hurts heat rate in a hurry. For instance, we are spending about **$53,324 per day** in additional fuel costs when K5 is offline on outage.

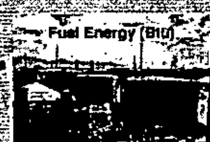


Heat Rate Orientation

Spring 2009

Heat Rate Primer

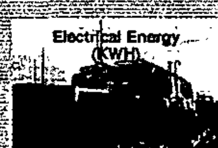
- What is heat rate?
  - Measurement of efficiency, it is simply the amount of fuel energy consumed, in British Thermal Units to produce a Kilowatt-Hour. So it is the ratio of what we put in (fuel energy) to what we get out (electrical energy).
  - Lower is BETTER.



Minimize this

$$\text{Heat Rate} = \frac{\text{Energy Input}}{\text{Energy Output}}$$

Maximize this



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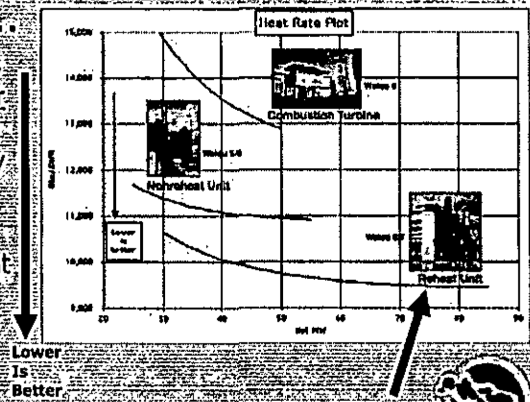
Heat Rate Primer

- More on heat rate..
  - We have 3 different types of units at HECO...and our reheat units are our most efficient ones, followed by nonreheat and then combustions turbines.
  - One key to managing heat rate is to maximize our reheat generation and capability!



Heat Rate Primer

- Why heat rate?
  - Heat Rate has a direct impact to the financial bottom line. Fuel cost is a major part of the cost of producing electricity.
    - Fuel costs account for +$525 million in 2007
  - The Public Utilities Commission has deliberately made heat rate an incentive for us by making fuel cost recovery based upon a fixed heat rate.
  - Fuel cost recovery from the consumer is based upon 10,602 Btu/KWH (2005 Rate Case).

10,666 Btu/KWH-2007 "interim" Rate Case

HECO Power
Supply

Heat Rate Primer

- What impacts heat rate?
  - Operations
    - How we operate our units compared to ideal conditions.
  - Maintenance
    - How frequently and how we repair/fix/maintain/overhaul our units.
  - System Conditions
    - These are requirements that we must meet to provide electricity to our customers including spinning reserve, system load, outages, duration of overhauls, derates.

HECO Power Supply

Heat Rate Primer

- Operations Heat Rate Impacts
  - <u>How we operate our units compared to ideal conditions.</u>
  - Factors include:
    - Managing excess O2% on boiler controls for efficiency vs clean stacks;
    - When auxiliary equipment is turned on;
    - Ensuring rated main steam temperatures/pressures;
    - Conducting good unit cycle isolation-high energy streams are directed to producing electricity than being rejected.

HECO Power Supply

Heat Rate Primer

- Maintenance Heat Rate Impacts
  - How frequently and how we repair, fix, maintain, and overhaul our units.
  - Factors include:
    - Quality work needs to be done on equipment to ensure we get good unit efficiency;
      - Boiler feedwater pumps, feedwater heaters, heater drip pumps, condensers, circulating water pumps, boilers, air heaters, etc.
    - Critical equipment returned to service quickly and as economically feasible as possible when units online;
    - Overhaul work are targeted for heat rate improvement.

HECO Power Supply

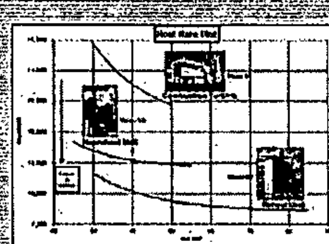
Heat Rate Primer

- System Heat Rate Impacts
  - These are requirements that we must meet to provide electricity to our customers.
  - Factors include:
    - System Load;
    - System Reliability Requirements;
      - Spinning Reserve;
      - Quick Load Pickup;
    - HECO and IPP Unit Outages and Derates;
      - Overhaul Schedules;
    - Line Outages/Maintenance;
    - Honolulu Operation during Kona Winds.

HECO Power Supply

Heat Rate Primer

- Why are these System Impact factors critical?
  - One key to low heat rate is ensuring that efficient, reheat units are providing bulk of generation.
  - System impact factors having a negative impact include:



•An outage of a HECO reheat unit causes less efficient cycling or CT units to operate for spinning reserve.
•Significant derates can cause this also.

•IPP outages will cause less efficient HECO units to run.

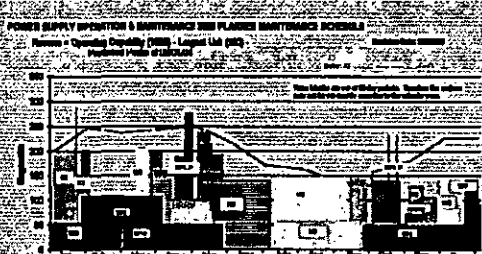
•Higher system peaks may cause cycling or CT units to operate.

•Cold plug in Honolulu fuel oil pipeline will cause less efficient CT units to operate.

HECO Power Supply

Heat Rate Primer

- More on System Impact factors....
  - Yearly overhaul schedules impact recorded as well as forecasted heat rates.



•A schedule with more reheat overhauls will have a higher heat rate than one with less reheat unit outages.
•Hence, yearly heat rates will vary since overhaul schedules vary for year to year.

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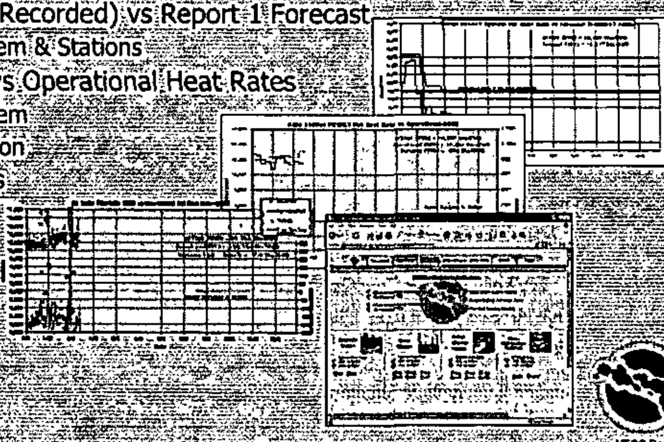
Heat Rate Monitoring

- Measurement (Weekly, Daily, Seconds)
  - System-all HECO Stations
  - Station Basis
    - Kahe
    - Waiau
    - Honolulu
    - Combustion Turbines
  - Unit Basis
    - Kahe 1 to 6
    - Waiau 3 to 8
    - Honolulu 8/9
    - Waiau 9/10

HECO Power Supply

Heat Rate Monitoring

- What heat rates do we track?
  - Actual (Recorded) vs Report 1 Forecast
    - System & Stations
  - Actual vs Operational Heat Rates
    - System
    - Station
    - Units



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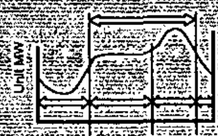
Heat Rate Monitoring

- What is the Operational Heat Rate?
  - Heat rate calculated from assumed unit efficiencies used in Report 1 Forecast and actual hourly loads on each individual units.
  - Calculated from unit and summed up for station and system.

Assumed Unit Efficiency
Or Input/Output Equation



Hourly Unit Loading for Day

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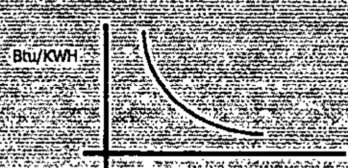
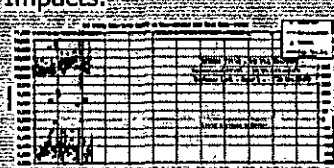
Heat Rate Monitoring

Why Operational Heat Rate?

- We need to accurately benchmark the efficiency of each of our units.
  - Heat rate is load dependent. At higher loads we will be more efficient and visa versa.
  - Different types of units have different efficiencies.
- CANNOT rely on a static forecast. System conditions vary upon weather, unit outages, etc.
- The Operational Heat Rate allows us to easily identify the Operations and Maintenance Impacts.





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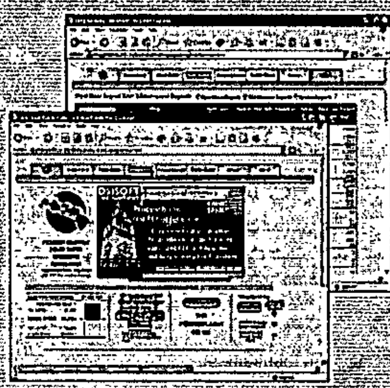
What can you do as new EO's to manage heat rate?

- Cycle isolation..preventing high energy flows from going into the condenser!!
  - Proper line up of valves-turbine drain valves closed when need to.
  - Check for boiler feedwater pump recirc. valves that they are closed when the need to be and are cold (no leakage). Be aware of stop valves.
  - High level dumps on FWHs closed. Are our drip levels okay?
  - Does FWH have a tube leak- check your levels.
- Condenser
  - ClO2 System is working
  - Check for leaks into condenser that make vacuum bad

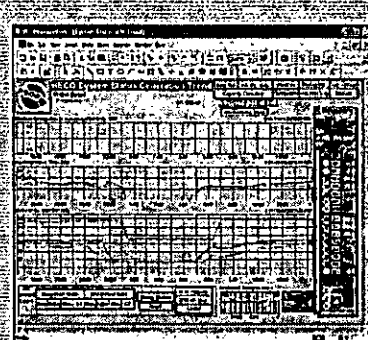
Want to learn more on heat rate??

- Please login to the Heat Rate Website
  http://172.30.132.31/heatrate/pages/notice.html
- You'll need a username/password as this site is considered company confidential.
- Heat Rate Website is our vehicle to communicate to Power Supply and Energy Delivery personnel
  - Available 24/7



New Real-time Tools

- OSI PI System
- Processbook/Datalink
  - Provide real-time unit loading, monitoring of unit conditions
  - Manage system reliability
  - Manage unit heat rate
  - Troubleshooting tool but live
- Live Demo



OSIsoft. PERFORMANCE-DRIVEN INTELLIGENCE

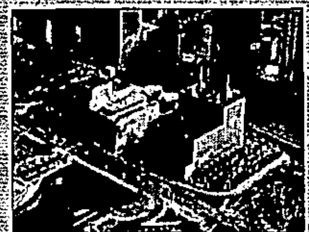
HECO Power Supply

Backup

- End

HECO Power Supply

Power Supply Power Plants



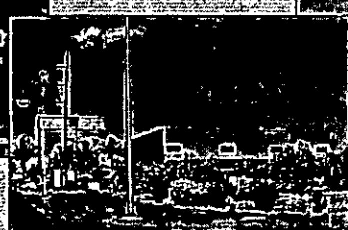
Waiau Power Plant
- 4 nonreheat units
- 2 reheat units
- 2 combustion turbines

Honolulu Power Plant
- 2 nonreheat units

Kahe Power Plant
- 6 reheat units

HECO Power Supply

Independent Power Producers



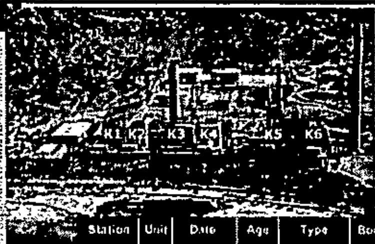
AES Hawaii
- 180 MW Capacity
- Coal fired, reheat unit
- 1 Steam Turbine
- Baseloaded

Kalealoa
- +180 MW Capacity
- 2 Combustion Turbines
- LSFO
- 2 HRSG's
- 1 Steam Turbine
- Baseloaded

H-Power
- 46 MW Capacity
- 2 Boilers
- Trash burning
- 1 Steam Turbine
- Baseloaded

HECO Power Supply

Kahe Power Plant



- Newest HECO units
- Most efficient HECO units are here
- 6 Reheat Units-small/large
- Uses LSFO as primary fuel
- K6 under more stricter emissions requirements

Station	Unit	Date On-Line	Age Years	Type	Boiler Manuf.	Turbine Manuf.	No. FWHs	Boiler Rated PSIG	Boiler Rated Temp. (F)	Gross Capacity (MW)
Kahe	1	3/4/63	42.0	Steam, Reheat	B&W	Westinghouse	5	1875	1005	90
	2	9/14/64	40.5	Steam, Reheat	B&W	Westinghouse	5	1875	1005	89
	3	8/29/70	34.5	Steam, Reheat	CE	General Electric	5	1875	1005	92
	4	6/25/72	32.7	Steam, Reheat	CE	General Electric	5	1875	1005	93
	5	12/30/74	30.2	Steam, Reheat	B&W	Westinghouse	6	1859	1005	142
	6	3/21/81	23.9	Steam, Reheat	B&W	Westinghouse	6	1859	1005	142
									TOTAL	648

HECO Power Supply

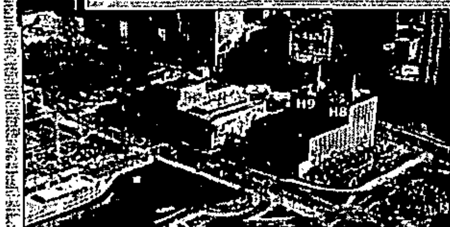
Waiau Power Plant

- 4 Cycling Units (W3/4/5/6)
- 2 Reheat Units (W7/8)
- 2 Peaking/Emergency Combustion Turbines (W9/10)
- Uses LSFO and diesel as primary fuel

Station	Unit	Date On-Line	Age Years	Type	Boiler Manuf.	Turbine Manuf.	No. FWHs	Boiler Rated PSIG	Boiler Rated Temp. (F)	Gross Capacity (MW)
Waiau	3	12/1/47	57.3	Steam, Non-reheat	B&W	Westinghouse	5	850	905	49
	4	10/25/50	54.4	Steam, Non-reheat	B&W	Westinghouse	4	850	905	49
	5	9/1/59	45.5	Steam, Non-reheat	B&W	Westinghouse	5	1315	950	57
	6	6/23/61	43.7	Steam, Non-reheat	B&W	Westinghouse	5	1315	950	55
	7	10/9/68	38.4	Steam, Reheat	CE	Westinghouse	5	1875	1005	92
	8	11/20/68	36.3	Steam, Reheat	CE	Westinghouse	5	1875	1005	94
	9	6/20/73	31.7	Combustion Turbine		General Electric				53
	10	12/12/73	31.2	Combustion Turbine		General Electric				50
									TOTAL	499

HECO Power Supply

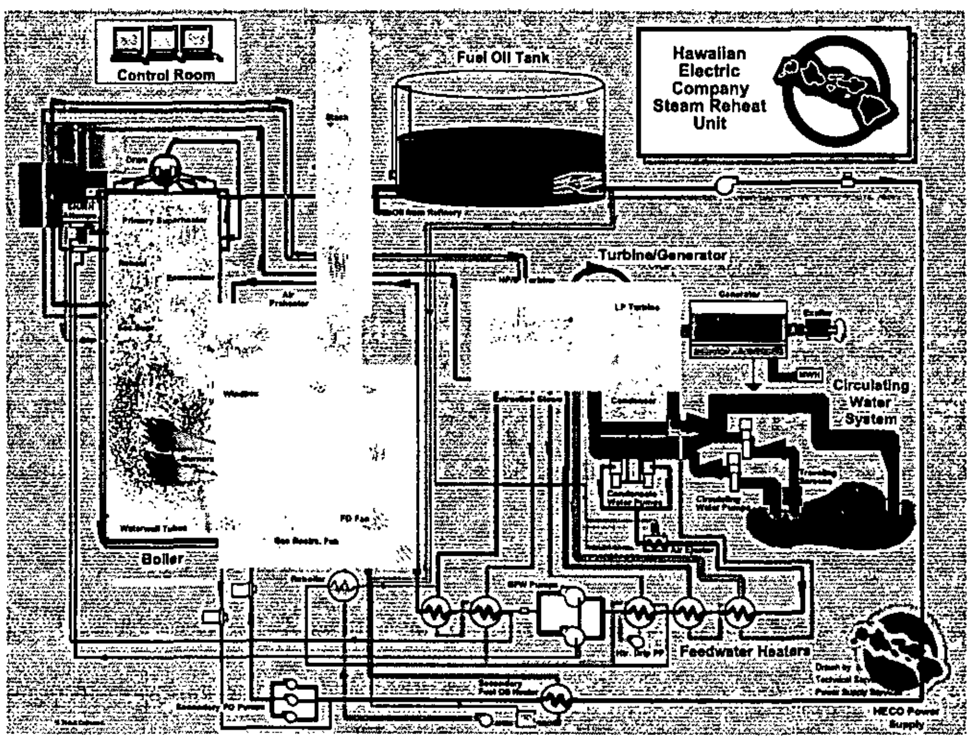
Honolulu Power Plant



- Oldest Power Plant
- 2 Cycling Units
- Uses LSFO as primary fuel
- Location and emissions require operation during normal tradewinds
  - Kona Winds is a no-no

Station	Unit	Date On-Line	Age Years	Type	Boiler Manuf.	Turbine Manuf.	No. FWHs	Boiler Rated PSIG	Boiler Rated Temp. (F)	Gross Capacity (MW)
Honolulu	8	12/17/54	50.2	Steam, Non-reheat	B&W	Westinghouse	5	1315	950	58
	9	11/7/57	47.3	Steam, Non-reheat	B&W	Westinghouse	6	1315	950	57
									TOTAL	115

HECO Power Supply



PUC-IR-109

Stipulated Settlement Letter dated May 15, 2009, Docket No. 2008-0083, EXHIBIT 1, page 16 states the following:

> The Parties agree that the CACF at current effective and present rates is 0.152 cents per kWh, 0.000 cents per kWh at proposed rates, and the sales heat rates used in the ECAF as fixed efficiency factors at proposed rates are:
>
> | | |
> |---|---|
> | LSFO: | 0.011114 mbtu/kwh |
> | Diesel: | 0.024582 mbtu/kwh |
> | Biodiesel: | 0.016762 mbtu/kwh |
> | Other plants: | 0.011184 mbtu/kwh |
> | Weighted average: | 0.011184 mbtu/kWh |

Please provide:

a) reasons why the heat rate for diesel is more than two times higher than that of LSFO, and reasons why HECO's heat rate for diesel is more than two times higher than that of any Maui districts;
b) an explanation as to why the heat rate for each fuel type is reasonable and fair;
c) the criteria and procedure that HECO uses to decide when and how to apply a fixed efficiency factor to DG fuel and transportation costs as HECO's DG units age; and
d) a comparison of impacts with workpapers and calculations to apply a fixed efficiency factor on DG fuel and/or transportation costs to HECO's DG units in ECAC.

<u>HECO Response:</u>

a. Before responding to the specific issues raised in part a) of this information request, it would be helpful to review the concepts of sales heat rate and net heat rate. In generating and delivering electrical energy to customers, the energy is first produced by the generators and delivered to transformers at the power plants. The point at which the energy exits the transformers and enters the power grid is referred to as the "net-to-system" point. From there, the energy travels through the electrical transmission and distribution system to the customer. Along the way to the customer, energy losses occur and additional energy is consumed for Company use. (Refer to HECO T-4, Attachment 1, page 3 of the Stipulated Settlement Letter filed May 15, 2009.) Therefore, the amount of energy arriving at the customer's meter (called the "customer level" or "sales level") is less than the amount of energy delivered at the net-to-system point.

The heat rate of a system can be calculated at the sales level or at the net-to-system level. For example, suppose it takes 100 x 10^6 Btus (100 million Btu or 100 MBtu) of fuel at the power plant to serve 10,000 kWh of sales at the customer level. Then the sales heat rate would be (100 x 10^6 Btus) / 10,000 kWh = 10,000 Btu/kWh-sales. Suppose further that in moving the energy from the power plant to customers, there are 480 kWh worth of energy losses and an additional 20 kWh are consumed for Company use. This would mean that 10,500 kWh of energy is delivered by the power plant to the net-to-system level. (10,500 kWh of energy delivered at the net-to-system minus 480 kWh energy losses and 20 kWh consumed for Company use = 10,000 kWh remaining for sales.) Therefore, the net heat rate would be (100 x 10^6 Btus) / 10,500 kWh ≈ 9,524 Btu/kWh-net.

The distinction between sales and net heat rates is important because HECO's analyses and most of the comparisons discussed in this response are on a net-to-system basis.

In order to see why the heat rate for HECO diesel is more than two times higher than that of HECO LSFO, one needs to consider both the fuel efficiency characteristics of the units that use diesel fuel and LSFO as well as how each type of unit is operated to serve system demand.

HECO has 16 generating units. Fourteen are steam units, which use LSFO, and two are combustion turbines, which use diesel fuel. (There are also three firm capacity independent power producer units but they do not enter the heat rate calculations.) Of the 14 steam units, eight (Kahe Units 1 to 6 and Waiau Units 7 and 8) are baseload units, meaning that they run 24 hours a day. The other six steam units (Waiau Units 3 to 6 and Honolulu Units 8 and 9) are cycling units, meaning that they are turned on in the morning and turned off at night. The two combustion turbines (Waiau Units 9 and 10) are peaking units, meaning that they are typically turned on in the afternoon and turned off at night in order to serve the evening peak, depending on the season. (Usually between April and August, system peak demand occurs during the day rather than in the evening so the peaking units would less likely be used.)

As for the efficiency characteristics of the units, please refer to the attached graph on page 7 of this response. For illustrative purposes, the efficiency (heat rate) curves are shown for Kahe Units 1 and 2 (baseload units running on LSFO) and for Waiau Units 9 and 10 (peaking units running on diesel). It can be seen that for both types of units, baseload and peaking, the unit heat rates are higher in the lower output range and lower at the higher output range. Also, the heat rates for the peaking units are much higher than that of the baseload units.

In serving system demand, the baseload and cycling units, because they are more efficient than peaking units, typically operate at the higher end of their output range. Consequently, their operating heat rates are at lower end of the scale. The peaking units, on the other hand, operate at the lower end of their output range because they are the last units to come on line (since they are the least efficient) and are used to serve the remainder of the system demand and to provide spinning reserve. Consequently, their operating heat rates are at the higher end of the scale.

In looking at the graphs on page 7 of this response, it can be seen that the heat rates for Kahe Units 1 and 2 are in the range of 9,900 to10,100 Btu/kWh-net near the upper end of their output range (80 to 90 MW). In contrast, it can be seen that the heat rates for Waiau Units 9 and 10 are in the range of about 41,100 to 39,350 Btu/kWh-net near the lower end of their output range (about 6 to 10 MW).

Given these unit characteristics and the mode in which the units serve demand, it can be seen why the diesel heat rate is significantly higher than the LSFO heat rate. For the production simulation for the test year, the average load on the steam units operating over the entire year was such that their overall composite sales heat rate was 11,114 Btu/kWh and the average load on the combustion turbines was such that their overall composite sales heat rate was 24,582 Btu/kWh.

The recorded diesel heat rates for each MECO Division in 2008 were as follows:

Maui Division:	9,224 Btu/kWh-net
Lanai Division:	10,387 Btu/kWh-net
Molokai Division:	10,198 Btu/kWh-net

For the Maui Division, a large proportion of the demand is served by two dual train combined cycle units. Combined cycle units are very efficient and typically operate at the higher end of their output range. A combined cycle generating unit is a combination of combustion turbines and a steam turbine generating unit. Hot exhaust gases from the combustion turbines are ducted into boilers which are also called heat recovery steam generators. Both the steam turbines and the combustion turbine drive electric generators to produce electric energy. The graph on page 8 of this response shows the efficiency (heat rate) characteristics of the dual train combined cycle units. At the higher end of the output range (about 50 to 55 MW), the heat rate is about 8,400 Btu/kWh-net. Since these units are baseloaded and are very efficient, it can be seen why the Maui Division diesel heat rate is much lower than that of HECO's diesel heat rate.

On Lanai and Molokai, system demand is served by diesel engines. Diesel engines are more efficient than combustion turbines. For example, in 2008, Lanai's and Molokai's actual average diesel system heat rate was 10,387 Btu/kWh and 10,198 Btu/kWh-net, respectively. Since Waiau Units 9 and 10 operate at low output where their heat rate is very high, it can be seen why the Lanai and Molokai Division diesel heat rate is much lower than HECO's diesel heat rate.

b. The heat rate for each fuel type is reasonable and fair because:

1) As explained in HECO T-4, pages 6 to 15, HECO uses a production simulation computer model, called P-Month, and the inputs identified on those pages and the related exhibits and workpapers, to estimate test year fuel efficiency (heat rate). This is the same computer model that has been used in numerous previous HECO, HELCO and MECO rate case production simulations where HECO's results were accepted by the Consumer Advocate and the Commission.

2) HECO annually calibrates the model to actual, recorded results and reports the findings to the Commission annually in March.

3) On May 15, 2009, HECO filed a Stipulated Settlement Letter in this proceeding that documented certain agreements between Hawaiian Electric Company, Inc., the Consumer Advocate and the Department of Defense regarding matters in this proceeding. As stated in Exhibit 1, page 13 of the Stipulated Settlement Letter, "The Consumer Advocate used the P-Month production simulation model to independently test the reasonableness of HECO's fuel and purchased power projections. (See CA-T-2, page 22)" The letter stated further, "The Consumer Advocate also used inputs from the Company's T-4 Rate Case Update, filed November 26, 2008, to benchmark its production simulation model results against HECO's production simulation results. (See CA-T-2, page 23) Although several generating units and purchased power resources were dispatched differently, the Consumer Advocate's production simulation results were similar to HECO's results.

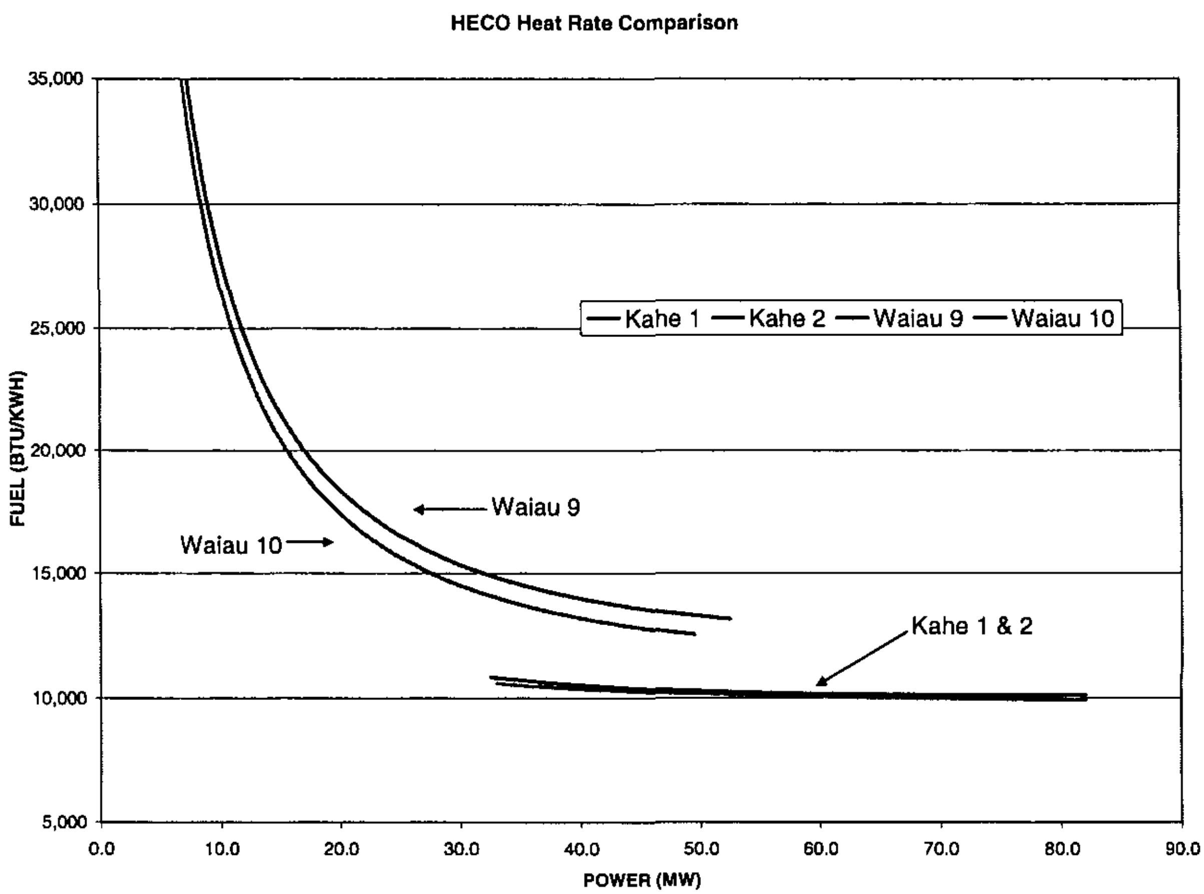
The small differences in energy generated by HECO's generating units were considered negligible."

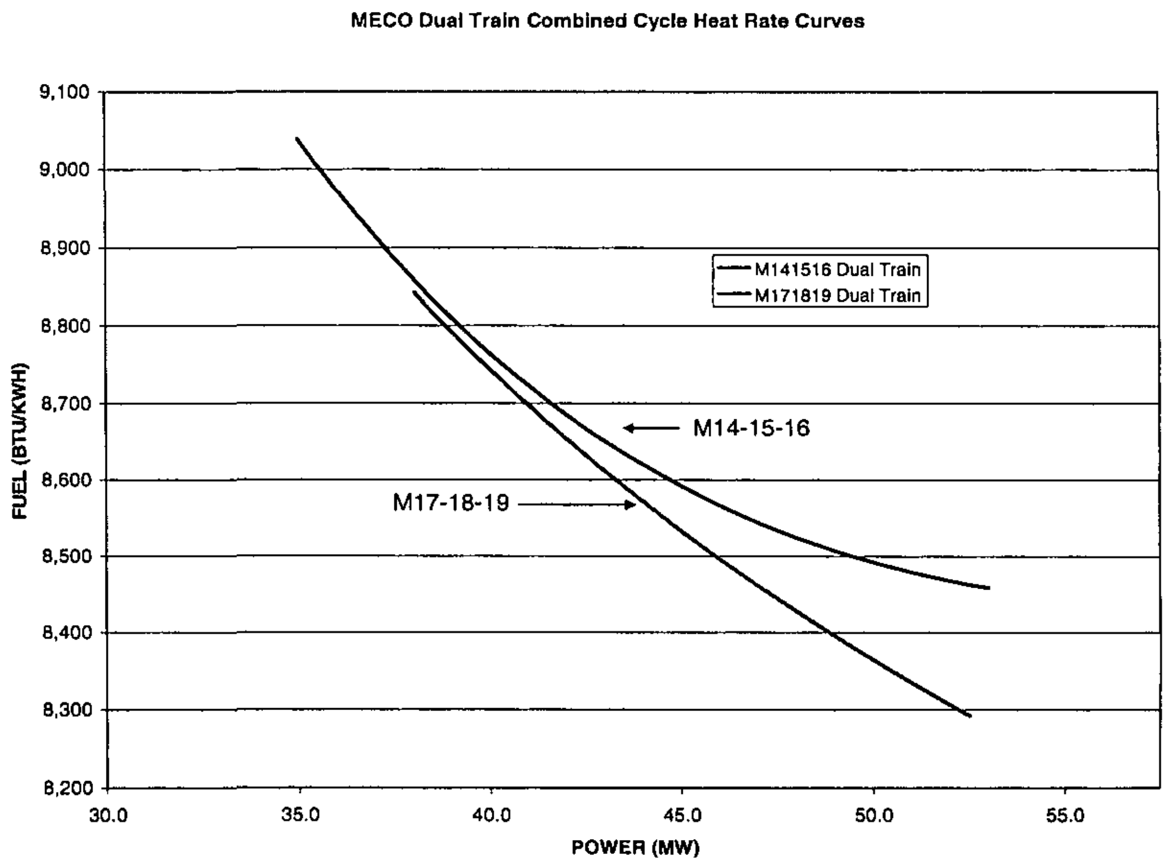
For settlement discussions, HECO ran another production simulation and agreed to reflect additional updates to the inputs. The results of HECO's April 24, 2009 ("April 2009 Update") production simulation run were provided to the Consumer Advocate and Department of Defense on April 30, 2009. Using HECO's April 2009 Update assumptions, the Consumer Advocate ran another production simulation in May 2009. The Stipulated Settlement Letter stated, on page 14, "Based on its review, the Consumer Advocate found its May 2009 Update and HECO's April 2009 Update production simulation results to be comparable and reasonable. According to the Consumer Advocate, the difference between the production simulation results represented a difference of approximately 0.008% of estimated test year fuel and purchased power expenses. As a result, the Consumer Advocate acknowledged HECO's April 2009 Update test year fuel expense, purchased power expense, <u>sales heat rate</u>, fuel inventory and ECA factor at current effective rates as reasonable, and acceptable for purposes of setting rates in this proceeding." (Underlining added.) The Stipulated Settlement Letter stated further, "For the purposes of settlement, the Parties agree to use HECO's April 2009 Update production simulation results and accept HECO's April 2009 Update 2009 test year total fuel expense, purchased power expense, <u>sales heat rate</u>, fuel inventory and ECA Factor at current effective rates." (Underlining added.)

Finally, on page 16, the Stipulated Settlement Letter stated, "The Parties agree that the ECAF at current effective and present rates is 0.152 cents per kWh, 0.000

cents per kWh at proposed rates, and the sales heat rate used in the ECAF as fixed efficiency factors at proposed rates are:

LSFO:	0.011114 mbtu/kwh
Diesel:	0.024582 mbtu/kwh
Biodiesel:	0.016762 mbtu/kwh
Other plants:	0.011184 mbtu/kwh
Weighted average:	0.011184 mbtu/kwh"





c. At this time, HECO does not have a specific criterion or procedure for deciding when and how to apply a fixed efficiency factor to DG fuel and transportation costs. HECO explained the reason for segregating the Company's DG installations from the Company's other utility-owned generators in the 2007 Test Year Rate Case, Docket No. 2006-0386. On page 60 of T-9 therein, HECO noted that DG units are generally more efficient than other Company-owned generating units and would tend to improve system efficiency and lower system heat rate. If the utility-owned DG generation were included with the Company's other utility owned generation, the resulting efficiency factor would be fixed in base rates. As the number of DG units increase over time, the actual system heat rate would improve. If the DG generation were included in the fixed efficiency factor, the heat rate improvements would not be passed through to customers. Separating the Company's DG generation from the Company's other utility-owned generation in the ECA factor calculation would allow the benefits of the DG units' improved efficiency to pass through the ECAC to HECO's customers. This was also re-iterated in this instant docket, in HECO T-10, pages 64-65.

d. Attachment 1 of this response provides a comparison of the weighted efficiency factors, with and without DG generation being included in the calculation. The top portion of Attachment 1 repeats the Final Settlement results. It illustrates that the overall weighted efficiency factor (line 3) without DG is 0.011184 mbtu/kwh ("Total" column). An "Illustrative Scenario which Includes DG" is then derived below the Final Settlement results, with the overall weighted efficiency factor (line 3R) of 0.011174 mbtu/kwh ("Total" column). The inclusion of DG fuel consumption and DG energy production in this illustrative scenario reduces (improves) the overall weighted efficiency factor by 0.000010 mbtu/kwh (line 4R), or approximately 0.09% (line 5R). The assumptions used in this illustrative scenario were obtained from the HECO T-10 portion of the Final Settlement in this 2009 test year rate case proceeding, as noted in the line item references.

Hawaiian Electric Company, Inc.
WEIGHTED EFFICIENCY FACTOR CALCULATIONS
CENTRAL STATION AND OTHER

2009 Test Year - Final Settlement

(Final Settlement Filed 5/15/09: HECO T-10, Attachment 1, Page 9 of 19)

At Proposed Rates

		LSFO	Diesel	Biodiesel	Other	Total	units
1	Fixed Efficiency Factor	0.011114	0.024582	0.016762	0.011184		mbtu/kwh
2	Gen Mwh %	99.47	0.50	0.03	0.00	100.00	%
3	Weighted Efficiency Factor (line 1 x line 2)	0.011055	0.000124	0.000005	0.000000	0.011184	mbtu/kwh

Reference:
1 Final Settlement Filed 5/15/09: HECO T-10, Attachment 1, Page 18.
2 Final Settlement Filed 5/15/09: HECO T-10, Attachment 1, Page 13.

Illustrative Scenario which Includes DG

Derivation of DG Fixed Efficiency Factor (same method used in WP 1037 p2 for LSFO, Diesel, etc.)

A	DG Fuel Consumed (MBtu)	39,252
B	Sales (GWh)	7484.7
C	% of DG Generation to Total System	0.05%
D	Kwh/Gwh Conversion Factor	1,000,000
E	Sales Heat Rate [line A ÷ (line B x line C x line D)]	$\boxed{0.010489}$

		LSFO	Diesel	Biodiesel	Other	DG	Total	units
1R	Fixed Efficiency Factor	0.011114	0.024582	0.016762	0.011184	$\boxed{0.010489}$		mbtu/kwh
	Derivation of revised Gen Mwh %, which now includes DG calculation							
F	2009 Mwh Energy (Central Station + DG)	4,480,620	22,738	1,301	0	3,771	4,508,430	Utility Mwh
2R	Gen Mwh %	99.38	0.50	0.03	0.00	0.08	100.00	%
3R	Weighted Efficiency Factor (line 1R x line 2R)	0.011045	0.000124	0.000005	0.000000	0.000009	0.011174	mbtu/kwh
4R	Reduction in Efficiency Factor [line 3 - line 3R]						0.000010	mbtu/kwh
5R	Percent Change in Efficiency Factor [line 4R/line 3 * 100						0.09	%

Reference:
A Final Settlement Filed 5/15/09: HECO T-10, Attachment 1, Page 12 of 19, Line 10.
B Final Settlement Filed 5/15/09: HECO T-10, Attachment 1, Page 19 of 19, Line 2.
C Final Settlement Filed 5/15/09: HECO T-10, Attachment 1, Page 13 of 19, Line 10.
1R Final Settlement Filed 5/15/09: HECO T-10, Attachment 1, Page 9 of 19, Line 1; and Line E for DG (as derived above)
F Final Settlement Filed 5/15/09: HECO T-10, Attachment 1, Page 13 of 19, Lines 4, 7, 8, and 10.
2R Recalculated to include DG MWh.